FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

The Prime Minister's Praise

THE Royal Air Force and its Allied comrades will certainly feel very gratified at the message sent to them by the Prime Minister through Sir Arthur Tedder. "It is certain," wrote Mr. Churchill, "the victories in Tunisia would never have been gained without the splendid exertion of the Allied Air Force under your skilful and comprehending direction."

It is only fair to reflect that likewise the victories would never have been won without the exertion of every other arm, and not least that of the supply services. But it is certainly true that the air arm has played a particularly useful part in most stages of the African campaigns. Perhaps the word in the Prime Minister's message on which most stress ought to be laid is "comprehending."

Air Chief Marshal Sir Arthur Tedder is in a unique and unprecedented position. He is the Air Officer Commanding-in-Chief all the Allied Air Forces in the Mediterranean, but, as was recently explained in *Flight*, an officer commanding-in-chief is not the same as a Commander-in-Chief. Sir Arthur Tedder owes allegiance to no fewer than three Commanders-in-Chief, namely, those of North-west Africa (General Eisenhower), the Middle East (Sir Maitland Wilson), Iraq and Persia (Sir H. Pownall), and also to the G.O.C., Levant (Lt. Gen. Holmes).

Fortunately not one of the three last has interfered with him, and one imagines that General Eisenhow can only have given broad indications of his requirements. Sir Arthur Tedder has been left free to manipulate the air contingents in the four Commands and the squadrons in Malta as has seemed best to him. He has varied his blows, sometimes striking out right and left, and sometimes concentrating, much as a chess player uses his bishops, knights and castles. It has been a masterly piece of work, and singles out Sir Arthur Tedder as perhaps the first really great air commander in history. When the Italians shot down the bomber which was taking his predecessor out to the Middle East, they little thought what a tartar they were bringing upon themselves and the Germans in the Mediterranean.

The last sentence of Mr. Churchill's message is also well worth noting. In speaking of "the united, efficient and individual devotion to duty which enabled so amazing a number of sorties to be made each day," he obviously paid a tribute to the ground crews as well as to the air crews, and for those devoted aircraftmen who kept airframes and engines in order no praise could be too high.

Civil Aviation

THAT tabling motions in Parliament and "getting a move on" in the Government are not the same thing was shown in both Houses last week, when the Lords discussed British Overseas Airways Corporation and the House of Commons debated cargo-carrying aircraft. On the whole, the Lords debate was the more useful of the two, dealing as it did with the broad general policy of post-war civil aviation. In the House of Commons Major Lyons asked about progress with production of cargo-carrying aircraft, and made a tactical error in his choice of phrase, since it gave Sir Stafford Cripps an opportunity, which he was not slow to take, for emulating Joad in the B.B.C. Brains Trust by saying it all depended upon what one meant by cargo-carrying planes. "It is a little difficult to know exactly what are referred to as cargo-carrying planes," Sir Stafford said. "All planes are cargo-carrying; it only depends on what is the cargo." That, we submit,

was unworthy of the Minister for Aircraft Production, and Mr. Stokes truthfully, if somewhat rudely, dismissed it as a legal quibble.

It is somewhat difficult to see why Members of both Houses, and Government spokesmen, should "both think they're saying 'am." To us it seems quite clear that we have to distinguish clearly between two things: our immediate war and post-war needs on the one hand; our long-term post-war policy on the other.

Collaboration with America

AFTER a lot of beating about the bush the Commons did, towards the end of the debate, come down to the question of wartime air transport, which is certainly not commercial—and sometimes barely civil! Of aircraft types used for wartime carrying duties Sir Stafford Cripps said that "we had mobilised the whole capacity for building such planes," but that the allocation of them was determined in consultation with our American Allies. If the Americans produced types that were particularly suited for transport while ours were better suited to bombing, we should use ours for bombing and theirs for transport. That, at last, is a forthright statement showing how closely the strategical requirements of the two countries are interwoven.

Of the aircraft types used or to be used in the war Sir Stafford Cripps was quite right to say that "it is not safe to give any information as regards any specific types of planes," but the same argument can hardly apply to post-war aircraft. There is little doubt that for the period immediately following the cessation of hostilities we shall have to depend very largely on American aircraft types. That appears obvious. But there does not appear to be any very good reason why we should not at once begin to plan our long-term policy and the aircraft types which will be needed for carrying it into effect.

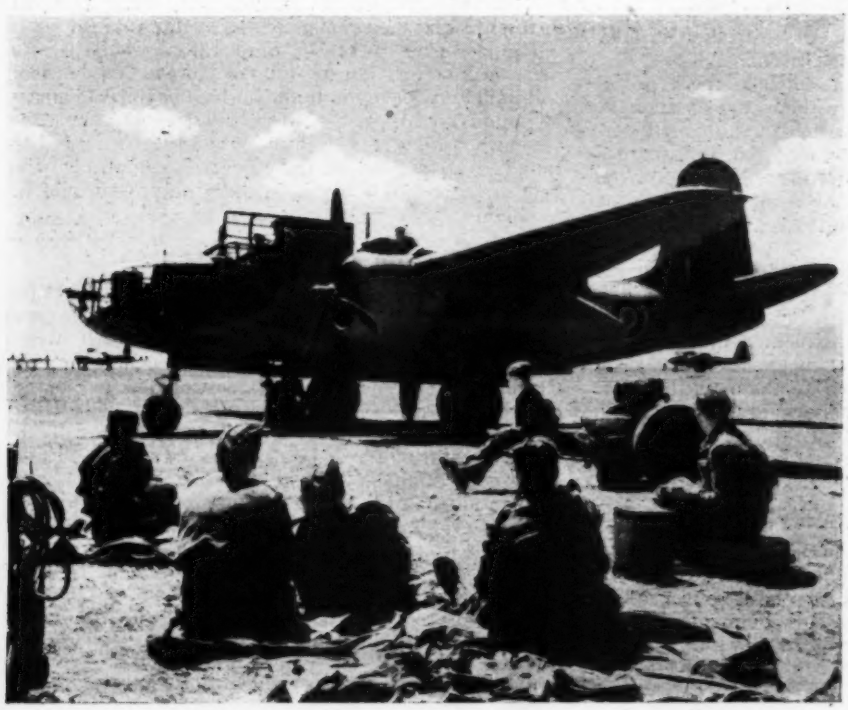
On the subject of preparation for the post-war period Sir Stafford said that we were much shorter of technicians than were our American Allies, due partly to lack of technical education in the past. Thus, we had no considerable number of technicians we could set aside for creating a department of civil aviation design.

We find some difficulty in believing that all our designing firms are so busy on present war problems that a number of men could not be spared sufficient for preparing the designs of two or three types which will obviously be wanted for Empire communications after the war.

We do not see eye to eye with those critics who would have the Government reduce bomber output by turning firms on to the building of transport aircraft for post-war use. As long ago as February 25th, 1943, we accepted in a leading article the official attitude to post-war policy in the following words: "Since it is an international problem, it has been intimated by Government spokesmen that discussion with our Allies will be necessary before a policy can be promulgated."

But as Lord Bennett said in the debate in the House of Lords on May 12th, although we cannot possibly have a declaration of international policy, "There is no reason why we should not have an Empire Air Service. We can create such an air service without impinging on the territory of any country in the world. That service, subject to international regulations which all countries use, would be free from international criticism.

Lord Bennett added that very sound comment that this should be carried into effect at once. "Then we should be in a position to talk internationally when the time comes to talk." There does not appear to be anything which we could usefully add to that.



TEDDER'S CARPET LAYERS: A Boston unit on a Tunisian airfield. While the North African armies wait for the next phase the air forces in Tunisia are busy "softening up" Italy.

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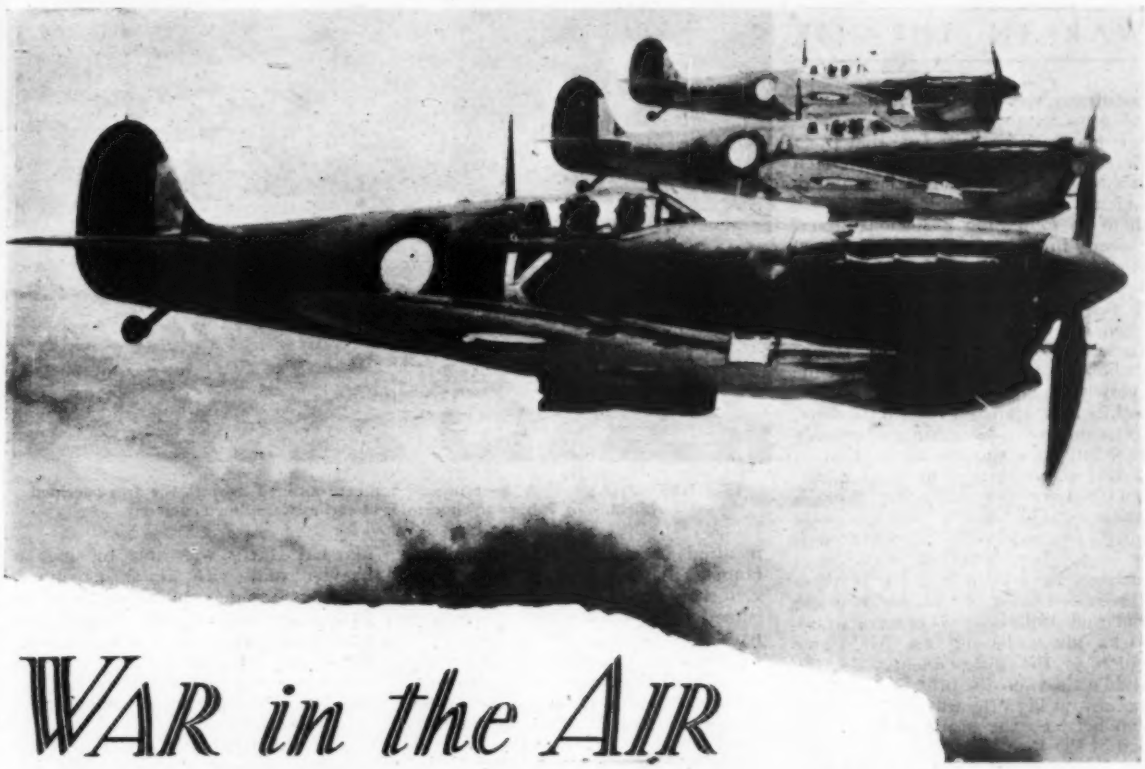


Spitfires are now taking part in the defence of Australia. The centre red ring has been removed from the usual roundels to avoid confusion with the Japanese red circle markings.

WAR in the AIR

Africa Cleansed of Axis Infection : 1,500 Tons of Bombs on Duisburg : Red Air Fleet's Activity

ONE would very much like to know what General Brauschitsch, late Commander-in-Chief of the German *Reichswehr*, is thinking just now. Since Hitler dismissed him and assumed the supreme command himself one large German force has been lost at Stalingrad and now another has gone the same way in Tunisia. Serving Generals are not allowed to say "I told you so," but some reflections not very unlike that must now be running through the mind of the dismissed Commander-in-Chief. Incidentally, it may be remembered that when the dismissal was announced *Flight* expressed in these columns its gratification at the prospect opening out for the Allies with Hitler as the supreme commander of the enemy. It was fully justified.

The Axis *débâcle* in North Africa was faced from the beginning with open eyes. When the Anglo-American force landed there, German and Italian troops were deliberately poured into the country, although Rommel had already been defeated at Alamein, and although the Axis held no mastery over the air and the sea in any part of the Mediterranean. Hitler could get troops in, but his staff must have known that it was doubtful if they could be got out. Obviously the strategic object was to delay the Allies while the southern coast of France could be fortified. Certainly delay has been caused, and no doubt the time has been spent industriously in building up fortifications along the Riviera—but at what a cost! The loss of von Arnim and his men (particularly his men) has been a major disaster for German arms and has tremendously lowered German prestige. It is for Hitler and his staff to judge whether the sacrifice has been worth while. We, for our part, shall be able to judge better when the next move forward by the Allies tests the strength of the Axis preparations. The hurried fortifications may be strong, but they cannot possibly compare with those erected along the northern coast of France and the Low

100-OCTANE LAUNDRY : Petrol tins serve for washing out the "smalls" on a Spitfire station in Tunisia.

WAR IN THE AIR

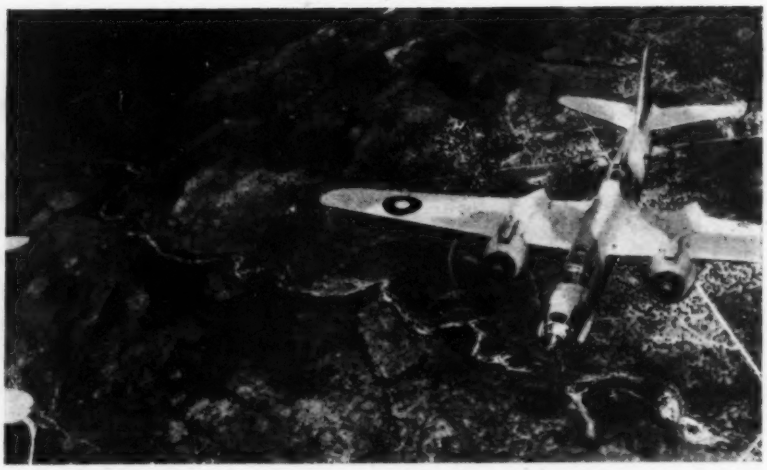
Countries, work on which has been going on for three years.

It may well be quite true that Field Marshal Rommel's health has broken down under the prolonged strain to which he has been subjected, but still there is something suspicious about the way in which he disappeared from the African scene before the final disaster. The *Luftwaffe* commander, Kesselring, presumably withdrew when his squadrons flew away from Tunisia and left the ground troops without any air protection against the overwhelming activities of the R.A.F. and its American and French partners. Outnumbered Kesselring certainly was, but none the less his reputation cannot stand as high as it once did. Details have not yet come through which would enable us to judge whether he handled his squadrons well or badly, but something more than rumours have been heard that there were differences of opinion between him and Rommel. There are drawbacks about having an Air Force which is too independent. In the Middle East, on the other hand, there has always been the warmest co operation between the heads of the Army and of the Royal Air Force, and when the Prime Minister laid it down that the R.A.F. must carry out the wishes of the G.O.C. to the utmost of its ability, even if that meant leaving alone other targets which appeared tempting to the local Air Staff, the behest was loyally obeyed with the happiest results.

The African campaign just concluded has been a masterpiece in many ways, but not least in the system worked out for combining ground and air operations so as to produce the best results. We thought that the Germans knew all about that when they overran France, but it is clear that their methods, though effective enough when they came as a surprise, were crude and rudimentary. Montgomery and Tedder are now the great authorities on that subject.

A point of no little interest about the recent fighting in Tunisia was the mention in a broadcast of Spitfire-bombers having been at work there. Evidently the Tactical Air Force had gained such complete supremacy and had such a margin of protective fighters that the fighter-bomber force could be strengthened by a number of Spitfires. The part played by fighter-bombers in the final assault was very great, and it was evidently good policy to strengthen it as much as possible.

By the same token, Typhoon-bombers have been mentioned as having made a raid in daylight on Abbeville, with an escort of Typhoon fighters.



THE LAST PHASE : A Boston day bomber outlined against the tree-speckled hillsides in Tunisia. Thousands of sorties were flown each day.

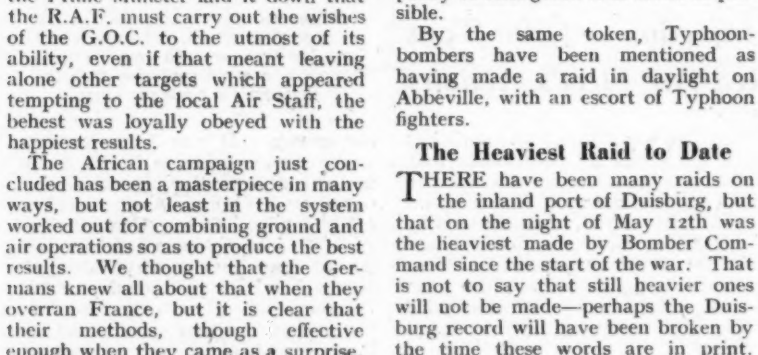
The Heaviest Raid to Date

THERE have been many raids on the inland port of Duisburg, but that on the night of May 12th was the heaviest made by Bomber Command since the start of the war. That is not to say that still heavier ones will not be made—perhaps the Duisburg record will have been broken by the time these words are in print. The number of bombers despatched did not reach 1,000—a figure to which the public has come to attach some mystical significance—but by using only four-engined bombers Air Chief Marshal Harris was able to stage a heavier raid with fewer machines. The number despatched was said to have been only slightly greater than what constitutes a normal heavy raid. It is, after all, the weight of bombs dropped which really matters, not the number of machines from which they are dropped.

The raid lasted only 45 minutes, and was concentrated in the main on the inland docks on the river. Points to note are that the time taken was only half that spent on the famous raid on Cologne, and that our losses in bombers this time were ten less than in the Cologne raid, 34 against 44.

It seems that of late there has been an increased tendency to pay special attention to Germany's communications. Her production is not being disregarded, as the blows on Essen testify, but it is just possible that striking at communications pays better dividends than bombing such a very large and dispersed area of production as that which Germany has at her command. Communications mean distribution, and if one can prevent munitions of war from reaching the firing line, one has achieved one's object just as certainly as if one had prevented their manufacture.

This Duisburg raid was a blow at distribution. In the final stages of the Tunisian campaign the Axis ran short of supplies, not because they had not been manufactured, but because they could not reach von Arnim's troops; the Navy and the R.A.F. cut the line from Sicily. We also notice the same policy being followed by the Red Air Fleet, which has recently grown to a size which outstrips the *Luftwaffe* in Russia. The Germans still have better communications behind their lines than the Russians have, and so the Red bombers have been paying much attention to railway centres in the German rear. A more ambitious effort recently took them to the railway stations in Warsaw. These raids



FIGHTER-TORPEDO-BOMBERS : Bristol Beaufighters making a torpedo attack on an enemy convoy off the Dutch coast. The photograph was taken from a fifth attacking Beaufighter.

ENEMY AIR LOSSES TO MAY 15th

	Over G.B.	Continent	Middle East	N.W. Africa
May 9	0	0	4	18
,, 10	0	0	0	6
,, 11	4	0	4	16
,, 12	1	2	1	7
,, 13	3	15	1	16
,, 14	0	11	0	3
,, 15	3	7	0	0
	11	35	10	66

Totals: West, 6,892; Middle East, over 5,319; North West Africa, 1,744.

not only tend to check the distribution of supplies to the German forces, but also to hamper the movement of German troops from one point to another. Obviously, good lateral communications behind the lines go some way to neutralise superiority of forces on the other side. The Russians have the superior forces, and it is now their object to use them to the best advantage, and to limit the German ability to concentrate on any specified point.

A Setback in Burma

THE British and Indian forces in the Mayu peninsula have had to withdraw from their advanced positions in the face of Japanese reinforcements. It is galling to have to retreat, and it is specially annoying when one holds air superiority. The R.A.F. and American bombers have been ceaselessly hammering Japanese positions and communications, and have met with very little opposition in the air, as the low figure of their losses prove, but evidently the Japanese still hold the trump cards on the sea and in the jungle.

However, as the monsoon is approaching, it is not all to the bad that our troops are not obliged to remain in particularly unpleasant and malarious front lines. At the same time, the unexpected journey of Field Marshal Wavell to Washington to consult with the Prime Minister and the President forebodes coming activity in the campaign against Japan. The leaders of the United Nations are always looking two moves ahead.

"Fort's" Bombload

HEAVY air attacks on the enemy in Northern Europe and on the Italian bases in the Mediterranean were the chief features of last week-end.

On Friday, May 14th, the R.A.F. and the U.S.A.A.F. carried out widespread raids on the Ruhr, Czechoslovakia, Holland, Belgium Kiel and Berlin itself, and the number of American bombers employed in four separate attacks constituted the largest single day offensive by the U.S. Eighth Air Force. American medium bombers, operating for the first time from Great Britain, were responsible for the successful low-level attack on industrial targets at Velsen, Holland, and none of them was lost.

By far the heaviest weight of bombers was directed against Kiel, where the shipbuilding yards and

WAR IN THE AIR

HIPS FIRM: (Left to right) Gen. Anderson, Gen. Alexander and Air Marshal Coningham conspiring against the Axis.

ways received particular attention because they now rank in first importance to the German U-boat building programme and for the repair of U-boats.

An important, and very significant, aspect of the U.S. Air Force's part in this hammering of the enemy's European stronghold is the news from Washington that Flying Fortresses intended for night bombing are being modified to increase their bomb-load "from three or four to ten tons," and that racks to carry a two-ton block-buster under each wing are being fitted.

Bomb Tonnage Raised

JUST as we go to press it is learnt that the record raid on Duisberg has, as we suggested might happen before this issue of *Flight* reached the reader, been raised again by the R.A.F. For Bomber Command broke that record 24 hours later in a series of three raids including one on Bochum, a big and vital transport centre in the Ruhr, where more than 1,000 tons of bombs were dropped, thus raising still higher the greatest total tonnage of bombs ever delivered to the enemy in a single night. Bochum, which is rather smaller than Dortmund, has—or perhaps one should now say had—several large plants producing the high-grade steel used in the manufacture of guns, aircraft and machine tools, as well as chemical factories and synthetic oil plants.

Crews reported a highly concentrated raid lasting from 2 a.m. until 2.45 a.m., during which comparatively short period our heavy bombers gave the enemy a non-stop performance. After the raid, crews returning from a raid on another target saw dense columns of smoke rising thousands of feet into the air and immense fires still blazing in Bochum.

Just how concentrated was this raid is indicated by the fact that one Stirling, on landing at its base, was found to have the tails of three incendiary bombs dropped by aircraft above embedded in its wings.

While this was going on last week Hitler's not very effective partner in the Mediterranean was also feeling the weight of the R.A.F. and its Allies as part of the "softening" process now being applied to Italy and her island possessions. Contemporary with the Navy's heavy bombardment of the island of Pantellaria, during which Fleet Air Arm pilots did some very accurate spotting for the guns, R.A.F. Wellingtons attacked Naples with block-busters and incendiaries, which they rained down on munition depots, oil-storage tanks, docks, marshalling yards, the arsenal and the local power station. Smoke columns from Vesuvius—which might be described as Naples' irrepressible fifth (smoke) column!—guided the Wellingtons to their target, and when they left there were big fires burning in the area.

Next day American Fortresses, Mitchells and Marauders paid a visit to Cagliari, the chief port and industrial centre of Sardinia. This raid has been described as one of the most punishing daylight raids yet carried out on any Mediterranean city.

BRITISH & U.S. AIR LOSSES to MAY 15th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
May					
9	0	0	0	0	5
10	0	0	0	0	5
11	0	0	0	1	1
12	0	34	0	0	0
13	0	37	8	0	1
14	0	11	3	1	2
15	0	0	6	0	0
	0	82	17	2	14

Totals: West, 6,015; Middle East, about 2,092; North West Africa, 664.

A.T.A. BENEVOLENT FUND

WE are happy to publish a further list of donations to this deserving fund:

Amount last acknowledged (excluding contributions from A.T.A. and B.O.A.C.	£7,327	7	11
G. H. Bittles	25	0	0
J. Keeling	21	0	0
Ladies' Welfare Committee (9 M.U.), R.A.F. Cosford	3	3	0
William Courtnay	5	5	0
Imperial Chemical Industries, Ltd.	1	10	0
	£7,383	5	11

HERE AND THERE

Ever-popular Airgraph

THE Belgian Chamber of Commerce in London have asked for an airgraph service between Great Britain and the Belgian Congo.

Local Policeman Makes Good

THE R.A.F. Benevolent Fund benefits to the extent of £5 as the result of a wager concerning the lifting of a 500 lb. bomb case recently on exhibition. Mr. Murray F. Smith, of Chichester, paid the cheque over to the R.A.F. Benevolent Fund as a result of a local policeman lifting the bomb case shoulder-high.

The cheque, forwarded to *Flight*, has been reposted to the proper quarter.

Canadian Air Crews Here

REINFORCEMENTS of Canadian air crews are arriving in the United Kingdom every month in numbers equivalent to a full Army battalion, according to Air Marshal Harold Edwards, Commanding the R.C.A.F. Overseas.

Each member of a Canadian air crew is fully qualified, having had up to eighteen months intensive flying training.

Additional to this flow of Canadians are R.A.F. reinforcements trained overseas, Empire and Allied personnel.

R.A.F. Kept Down Our Casualties

VISCOUNT TRENCHARD, Marshal of the R.A.F., in a speech at Birkbeck College recently, said that without the R.A.F., casualties in Tunisia and Libya would have been ten times as great as they were. Air power, he said, had saved an untold number of casualties.

"It has a greater power, in my opinion, over the sea than it will ever have over the land," he added. "Great as it has been in Libya and Tunisia, it will have a greater influence over the sea than anywhere else."

Under New Management

IT is understood that the whole of the share capital of Motor Panels (Coventry), Ltd., has been purchased by Rubery Owen and Co., Ltd., of Darlaston (Staffs).

The board has been reconstituted in accordance with the change of ownership, and it is intended that the company should be continued and developed in accordance with the practice of the new owners.

Heading a Mission to U.S.

CALLERS at the London office of the Bristol Aeroplane Co. during the next few weeks will miss the genial presence of Capt. K. J. G. Bartlett, formerly the firm's Continental representative but more recently with headquarters at No. 6, Arlington Street.

The reason is that Capt. Bartlett is paying a visit to America as head of the company's mission to that country.

We wish him a successful visit and a safe return to St. James's.

Pioneer's New Post

CAPT. VICTOR SHEPERD, a pioneer in the development of safety glass and associated with the "Safety First" movement since its earliest days, has resigned from the board of the Triplex Safety Glass Co., Ltd., and its associated companies, to join the board of directers of British Indestructo Glass, Ltd.

NEW JOB FOR AN OLD SERVANT: The Fairey Albacore, last of a long line of Naval biplanes, has done some good work with an 18in. torpedo slung between its wheels. Now this faithful, though not too swift, servant of the Fleet Air Arm has a new job, and this echelon formation carries mines slung in the torpedo crutches.

Avro Lancaster II

MENTION may now be made of the Mark II version of the Avro Lancaster heavy bomber. It differs from the Mark I Lancaster in that air-cooled Bristol Hercules engines are fitted instead of the liquid-cooled Rolls-Royce Merlins. Canadian-built Lancasters with Packard Merlins will soon be flying across the Atlantic.

To Protect Private Owners

WHOEVER else in this country may be content to leave matters concerning civil aviation until the war is over, the Royal Aero Club is not guilty of such procrastination.

Within the proper limits imposed by wartime conditions, in fact, it is very much alive and active, and one of its latest moves has been to appoint a sub-committee whose special duty will be to watch over the interests of the private owner and private flying in general.

The sub-committee consists of Sir Lindsay Everard, Lt. Col. H. J. Aldington, Mr. S. Kenneth Davies, Mr. E. J. P. Eugster, Commander Francis Francis, Mr. H. W. H. Moore, Major H. A. Petre, D.S.O., M.C., and Air Comdre. H. M. Probyn, D.S.O.

For the year 1943-44, Lt. Col. Sir Francis K. McClean, A.F.C., has been appointed chairman of the club, with Major Petre as vice-chairman.

Air Chief Marshal Sir Arthur M. Longmore has been elected to fill a vacancy on the committee.

"Seadromes" Again!

PENNSYLVANIA - CENTRAL Air Lines are reported to have filed a formal application with the U.S. Civil Aeronautics Board for permission to establish seadromes between America and Britain—presumably after the war.

The object is stated to be that of providing America with vitally needed bases in the Atlantic, and the shortest, fastest, and most economical air route between the two countries.

No Monopoly

THE idea is to install seadromes every 800 miles, and officials of the company have said that their construction will begin as soon as steel is again available. They are to have a draught of 160ft. to ensure complete stability in the worst seas, a landing deck 70ft. above the water-line, and a weight of 64,000 tons. According to Mr. Bevell Munro, president of the company, the seadromes would be available to the airlines of all nations.

An important point, he said, was that land aircraft such as are now in use would be able to cross the Atlantic easily and economically, refuelling on the seadromes, which would, of course, provide complete airport and hotel facilities.

M.A.P. Appointment

SIR CHARLES BRUCE GARDENER has been appointed Controller of Labour and Supply at the Ministry of Aircraft Production. He will have the advisory help of the Departmental Production Efficiency Board, of which he is chairman, and will be a member of the Aircraft Supply Council.

To enable him to give full time to his new duties, the S.B.A.C. has agreed to release Sir Charles from the post of chairman, which he has held for the past 5½ years.

Turbines

THE booklet "Gas Turbines and Jet Propulsion for Aircraft," by G. Geoffrey Smith, M.B.E., having been out of print for some weeks past, a reprint is on the press embodying the article "Turbines of the Flying Wing" in the last issue of *Flight*. Copies will be available from our publishing offices shortly, price 3s. 6d., plus postage 3d.

Thunderbolts over Britain

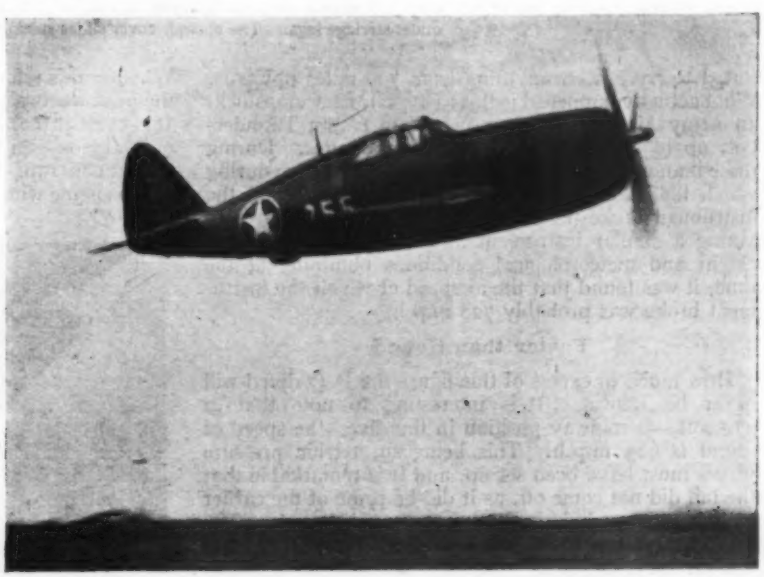
EIGHT-GUN AMERICANS : Republic Thunderbolts (P.47) of the U.S.A.A.F. in formation.

Eagle Squadrons Given America's Latest Fighters in the European Theatre : Height-cover Aircraft with Exhaust Turbo Superchargers

THOSE correspondents who have written to us pointing out that they think they saw a Republic Thunderbolt flying over may now officially be told that their eyes were not playing them tricks: the much-publicised P.47 has arrived on the British air front.

Flight recently visited one of the U.S. Army Air Corps fighter stations and saw a number of Thunderbolts show their paces. Obviously, a machine designed for height-cover fighting is at a disadvantage when flying low down; nevertheless, they were rather impressive.

The bare mention of the Thunderbolt brings to memory the claim that it has been dived at a speed variously



GIVING BRITAIN THE LOW-DOWN: The Thunderbolt shooting up its home station. It is, however, a height-cover fighter and is not used for low strafing. (*"Flight" photograph*)

D

"Flight" photographs.

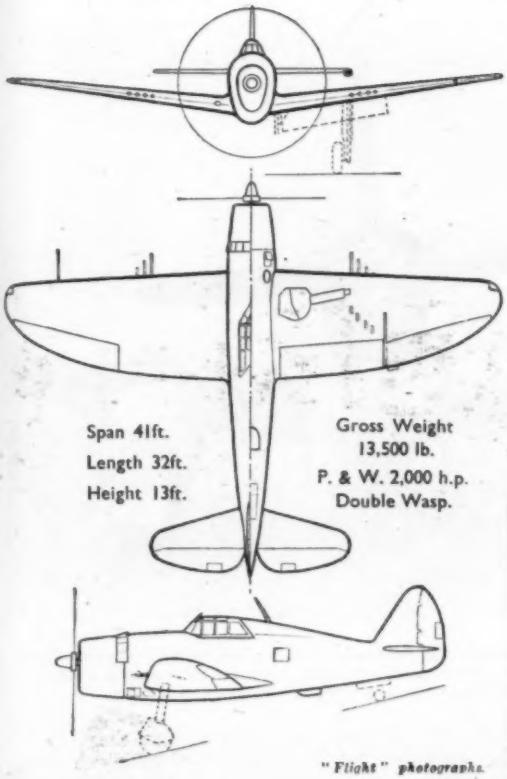
Two general views of the P.47. The four-bladed airscrew of 12-ft. diameter gives a reasonable ground clearance with short undercarriage legs. The cockpit cover slides straight back.

stated to have been anything from 700 miles upwards. What actually happened is this: One 1st/Lt. Compstock, an Army Air Force pilot, was told to take a Thunderbolt up to 36,000ft., and practise aerobatics. During these manœuvres Lt. Compstock went into a dive during which the A.S.I. went right "off the clock," and the instrument broke before he pulled out at 19,000ft. By taking a similar instrument and calibrating it for the height and meteorological conditions obtaining at the time, it was found that the airspeed at which the instrument broke was probably 728 m.p.h.

Faster than Sound

How much in excess of this figure the P.47 dived will never be known. It is interesting to note that at 27,500ft.—a midway position in the dive—the speed of sound is 685 m.p.h. This being so, terrific pressure waves must have been set up, and it is remarkable that the tail did not come off, as it did on some of the earlier models when diving tests were carried out. The Thunderbolt has been designed as a high-altitude, fast fighter. It is said to be capable of operating at 40,000ft. Whether this refers to a pressure-cabin model or whether the pilot wears a pressure suit at this height is not stated. It is evident that 40,000ft. is beyond the height at which ordinary oxygen masks are effective.

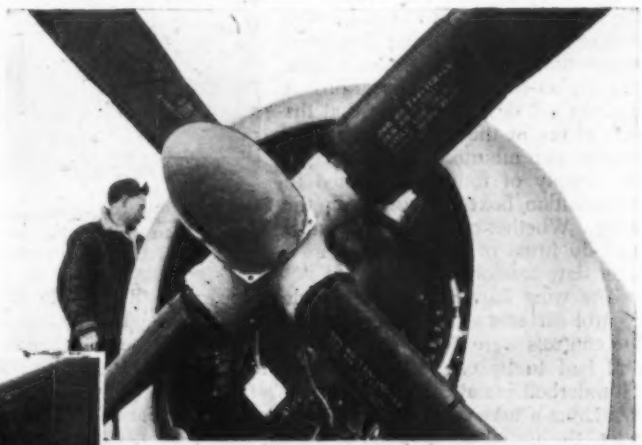
A 2,000 h.p. Pratt and Whitney R. 2800 Double-Wasp engine with turbo supercharger drives a 12ft. four-

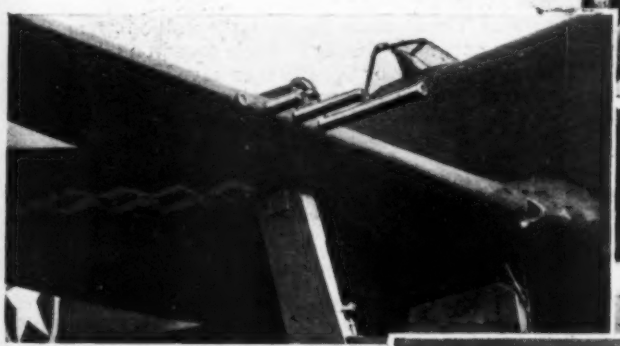


"Flight" photographs.

bladed, fully feathering, constant-speed Curtiss electrically operated airscrew. This power puts the Thunderbolt into the "400 m.p.h.-plus" class. The turbo blower and supercharger intercooler are both in the rear of the fuselage, and all the necessary ducts are beneath the pilot's floor. As is not unusual with exhaust-driven turbo blowers, there has been some difficulty with boost control, but this is not now a serious trouble. There is, however, a red-light danger signal on which the pilot has to keep his eye to avoid over-revving the turbine rotor at altitude. The maximum permissible speed is 24,000 r.p.m.

To lead internal pipes carrying the hot exhaust gases from the engine to the supercharger at the rear of the fuselage has presented a number of new problems. Some fires occurred during prototype tests, and in the United States there is a standard joke about "the smell of burning tail wheel." Ferrying range of the Thunderbolt is given as 1,000 miles.





(Left) The single-leg retractable tail wheel. (Centre, top) The four 0.5in. machine guns in the starboard wing. Ejection orifices for the spent cartridges and belt links can be seen on the underside. (Centre, below) All the tail surfaces of the Thunderbolt are metal covered.

(Top) The cuffed shanks of the four-bladed airscrew. (Bottom) The treaded tyre is inflated to 45 lb. per sq. in., and the oleo leg is compressed during retraction. (Left) Air which has passed through the supercharger intercooler exhausts from a vent in the fuselage side and the engine exhaust gases, after having actuated the turbine, come out below the body.

THUNDERBOLTS OVER BRITAIN

The fuel tanks are in the body.

The offensive armament is of particular interest. It is the direct outcome of the effectiveness of our 0.303 eight-gun fighters in the Battle of Britain. American experts who were holding a watching brief in this country at that time were so impressed that the eight-gun arrangement became the object to be aimed at.

Fire-power Increase

By stepping up the calibre of the machine-guns to 0.5in., the striking power has been increased many times (a 0.5in. bullet weighs 714 grains as against 160 grains of a 0.303in.), despite the fact that the rate of fire of the 0.5in. is only 800 rounds per minute. For each gun the supply of rounds is carried in ammunition boxes lying flat in the wing. Whether cannon armament is already fitted or will be fitted at a later date cannot be stated.

"*Flight*" *photograph.*

The egg-shaped cowling enclosing the Pratt and Whitney Double Wasp engine of the P.47 is an easily recognisable feature. All the eight 0.5in. machine guns are outside the airscrew disc and can employ their full rate of fire.

The wing flaps are of the Fowler type, and all the control surfaces are metal-covered. Originally, some of the controls were fabric covered, but they gave trouble and had to be changed. All the pilots say that the Thunderbolt is now an easy and pleasant aircraft to fly. Watching a take-off in the hands of an ordinary Service pilot, the initial acceleration appeared rather slow.

Our Allies realise how fortunate they were to be able to take over the Eagle squadrons from the R.A.F., because, although they have plenty of excellent pilots, these pilots are without much operational experience. The first Thunderbolts to go on operation from this country were in the hands of Eagle squadron pilots, and already some four or five FW 190s have been shot down by them. This operational experience can now be passed on to the "green" pilots.

In Parliament

Lords Discuss Post-war Policy and B.O.A.C. : Need for Design and Development of Civil Transport Types Stressed in Commons

AVIATION, now and after the war, has again been a prominent subject in both Houses of Parliament. In the Lords, recently, considerable time was devoted to a long discussion on the position, now and in the future, of the British Overseas Airways Corporation, and of the Government's attitude and policy (if any?) towards post-war civil flying.

LORD ROTHERMERE, who opened the subject by asking the Government to explain their policy for the development of civil aviation, and to give the reasons governing the selection of directors of the B.O.A.C., said that the recent resignations from the board did not take place through pique, owing to the formation of Transport Command, but because those directors felt they had the responsibility of being the custodians of the future of civil aviation, and that they could not maintain themselves in that position, *vis-à-vis* the Secretary of State and the country, unless they were given more responsibility and not less.

The position of B.O.A.C. was not clear, and any new directors would find themselves facing the same problems and having to ask the Secretary of State the same questions. He hoped they would get an answer, because the old directors never got one.

One question was whether it was intended that B.O.A.C. should remain the sole British instrument for overseas air transport, or, if not, what limitations were intended? Quoting Lord Sherwood's answer to that question, Lord Rothermere said that it meant "precisely nothing."

"It simply means," he said, "that the situation will remain the same provided it is not altered."

They had not had a single word as to what was the view of the Government on that question, and there were other matters on which he thought they should have a reply from the Government. He imagined that the Corporation would remain the chosen instrument of the Government and that it was very unlikely that the financial, organising and research sides would be possible for anything but a Government organisation. That being so, he thought B.O.A.C. should be given a great measure of independence. They should not, for example, have to rely upon the Research Department of the Air Ministry, which, very naturally, was concerned primarily with the R.A.F., whose requirements were entirely and absolutely different from those of a Civil Air Service, particularly in reference to safety.

Saying that practically all the suggestions and keenness for civil aviation had come from the Back Benchers of both Houses, and that all they got from the Government was either obstruction, apathy or inertia, Lord Rothermere expressed the hope that the Government would alter its opinion in these matters. He would even encourage those

IN PARLIAMENT

who might have a financial interest in aviation—the shipping companies—and while he did not think private enterprise could run post-war civil aviation on a big enough scale, he believed it should be encouraged to help.

On the broad principles of policy, Lord Rothermere said that a conference with the Dominions was a fundamental necessity, and he stressed the fact that Great Britain could only take its rightful place in aviation if the Empire was considered as a whole.

International Fallacy

"I would urge your Lordships to thrust aside this question which crops up from time to time, especially in the minds of Government departments, that the air transport service after the war will be an international one," he added. "Of course, it will not be an international one. It is perfectly useless trying to imagine you can run an international air service." And he went on to say that if an international air service were formed after the war, there was not the slightest doubt as to which country would conduct it and provide the aircraft—and it would not be Great Britain.

The MARQUESS OF LONDONDERRY supported Lord Rothermere, and said that he had raised the question on previous occasions, but each time it was raised the Government's reply had been so inadequate that they felt it their duty to go on pressing the Government to enunciate a definite policy. And if they did not get a statement of definite policy from the Government this time, then they would raise it yet again, because they were determined to carry the Government with them even though it appeared to be lacking in energy and apathetic towards the air.

This indifference towards the air question, Lord Londonderry intimated, was reflected in the daily newspapers which, in reporting speeches by leading members of the Government, hardly ever included a reference to the subject. The report of a recent speech by the Home Secretary was an example, and he had read speeches by the Minister of Education in which he had never found a single word of the development of air-mindedness in this country. But in America every newspaper report one read showed that all the education authorities, including the universities, were taking tremendous interest in the subject. Children were being impregnated with the knowledge of the air and what it meant, and what the developments were likely to be.

Empire Aviation

VISCOUNT BENNETT pointed out that B.O.A.C. was owned by the people of this country, which meant, for this purpose, the Government. It was, therefore, the job of B.O.A.C. directors to give effect to the Government's policy. Therefore the Government should declare a policy, otherwise the directors could not carry it out. His complaint was not that the directors of the corporation had not made a declaration, but that the Government had not told the directors what their policy was. But it was idle to ask the Government to make a declaration of its international policy at present; that could not be done until hostilities had ceased and understandings with other peoples had been reached through discussion. But there was no reason why the Government should not take a decision with respect to the Empire, and call together a conference with the Dominions to deal with it. They could create an Empire Air Service without impinging on the territory of any country in the world.

On the question of aircraft design, Viscount Bennett said that while it was feasible to carry on a mail service with converted bombers, you could not invite peacetime passenger traffic in converted bombers; you needed properly designed aircraft for that purpose, and he thought they could spare a designer for that job without lessening the war effort. He felt very strongly that unless they did something about it we were going to lose our place and our prestige, and sink to the level of a second-rate Power.

LORD SEMPILL, LORD BARNBY and LORD GIFFORD also spoke, and then LORD SHERWOOD replied for the Government. "On the question of civil aviation generally I must tell your Lordships quite frankly I have got nothing new to say to you to-day," he said, and added that they must not think that the Air Ministry was trying to keep down civil aviation. As a department they were determined, like everyone else, that civil aviation should get the greatest support and the squarest deal possible at the present time.

On the question of B.O.A.C., Lord Sherwood said that on the outbreak of war the corporation was required to place itself at the disposal of the Secretary of State, who assumed responsibility for the direction of its policy. There had been a good deal of misunderstanding on that point; it had been suggested that the Secretary of State had been trying to encroach on the functions of the B.O.A.C., but surely a man couldn't poach on his own preserves. Nevertheless, management and staff questions were left entirely with the corporation, and he recalled an occasion when Capt. Balfour was criticised because he would not take action on an individual case concerning a member of the B.O.A.C. staff; in spite of pressure he had refused to interfere in a staff question.

On other points Lord Sherwood said that B.O.A.C. had been given the best aircraft available, and this year definite allocations of first-class aircraft had been made to them, that they had had a fair allocation of spares, and that where control was concerned they were in no different position from that of the railways and shipping companies. The question of principle over which members of the board resigned was their desire to equate all regular trunk services, in regard to which the Secretary for Air could not agree with them; that was the sole reason. The present board was working well in close co-operation with Transport Command, but he was not in a position to make any announcement about the appointment of the remaining members. If they would wait a little longer he thought they would find a well-balanced board. The policy of the Government was, as stated by the Minister of Aircraft Production, that they were not prepared to sacrifice war necessities to any advantage they might gain after the war. But consultations were going on with the Dominions, and later there would be consultations with the United Nations in order to formulate an agreed policy.

Transport Aircraft

MAJOR LYONS (Leicester E.) raised in the Commons the question of transport aircraft for the Services, and said he hoped the departmental tempo was not far too slow in the present struggle, and he wanted some reassurances on this very vital matter. It might be that American transports were coming through, but it should not be left entirely to America, who, according to an extract he read from an American magazine, had not enough for her own needs. Could not airframes be made in India, South Africa, and elsewhere, engines and the necessary equipment being supplied by this country and Canada, and shipped overseas? Could not designs of materials be simplified and standardised and even localised? There were sufficient men and women, irrespective of race and colour, throughout the Empire, ready, willing, and able to undertake the work after instruction. This was an air age, and we must not rely wholly on wheels. They needed a supply of rapid, big, cargo-carrying airliners, and he hoped it would not be a case of too few or too late. But at no time, so far as he knew, had the House been given any really reassuring information on this question.

"The mere placid, self-satisfied assurances given by the right hon. and learned gentleman's predecessor, and more or less repeated by him a few weeks ago," said Major Lyons, "do not inform the House of the strides which have been made, which ought to have been made, and which we are pressing should be made in this new method of transport."

Post-war aircraft were referred to by GROUP CAPT. WRIGHT (Birmingham, Erdington), who said we were at least five years behind the U.S. and that it was ludicrous to propose that, after the war, we were going to compete for the passenger traffic of the world with converted bombers, while our friendly rivals across the Atlantic were using the magnificent aircraft they were producing in such enormous quantities to-day. It would be well worth employing a few people to-day in getting designs ready so that, when the war ended, we could keep our aircraft industry in continuous production.

MR. STOKES said that so far as he understood it, we had nothing ready on the drawing boards to meet post-war needs, and it was a vital matter which was not receiving adequate consideration.

SIR STAFFORD CRIPPS said it was not safe to give any information on specific types of aircraft, but he gave a general assurance that the allocation of the types of aircraft was governed by the fitting in of our plans with those of our American allies, in the light of all strategical requirements. On post-war designs he said we were very much shorter of highly skilled research workers and draughtsmen than our American allies, and there were none to spare, to-day, to create a department of civil aviation design. Nevertheless, they were doing what they could in that direction. He did not think we could take our place in post-war civil aviation with converted bombers and had never thought so. They would do all they could to expedite the preparation of civilian aircraft, but not at the expense of the Fighting Forces.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

A.R.P.

A NEW order issued by Goering proclaims that in addition to building experts and auxiliary workers already recruited, the entire population must be called up for help after raids in clearing streets and for repairing buildings housing vital services.

In areas exposed to R.A.F. raids, all services must form so-called "A" squads for street clearing and "B" squads for auxiliary repairs. The "A" squads, each ten to thirty men strong under a leader, are composed of unskilled labour. "B" squads will be employed to assist professional builders on urgent repairs of buildings and public services.

Operations

WHILE the *Luftwaffe* had to retreat from the skies of Africa, it is by no means inactive. Apart from being hammered by the Russians, units of the *Luftwaffe* are reported to be engaged in operations against guerillas in different parts of Europe. In Norway, German aircraft are being used to hunt Norwegians attempting to escape to Sweden. In the Balkans, *Luftwaffe* units had to be thrown in to assist the troops in fighting the guerillas, and in Poland and Occupied Soviet territories numbers of aircraft are constantly engaged on patrol duties guarding the rear communications of the German army from saboteurs.

Socks from Coal Tar

IN a lecture before the Medical and Natural Science Society of Jena, Prof. Heller gave some interesting details about the development in German artificial fibre production. Because of the shortage of cellulose, the production of which consumes vast quantities of timber, a new "ersatz" source for the manufacture of fibres had to be looked for. This has been found in coal-tar, which serves as the starting material for the new "perlon fibre" materials. According to the lecturer, the new fibre is particularly elastic, can be easily dyed, and its strength and durability surpasses any other artificial fibres.

The *Luftwaffe* and the army are being supplied with socks made of a mixture of 70 per cent. cellulose fibre and 30 per cent. perlon. It is said that such socks worn for 186 days in heavy boots and washed 62 times did not show a single hole. Since experiments have shown that materials made of perlon fibre last eight times longer than artificial silk or other substitutes, it is expected that the new product will be extensively used in army supplies and in the aircraft industry.

Luftwaffe Auxiliaries

SHORTLY after Hitler's announcement of total mobilisation following the defeat at Stalingrad, the *Luftwaffe* began to take in an increasing number of women for auxiliary services. Recruiting of women for the German Air Force has been for some time in existence, and feminine units have for some two years been on service in different parts of the Continent. But the growing pressure on man-power extended the range of service of women in the *Luftwaffe*, and to-day they are engaged on practically all auxiliary services.

A more recent measure is the recruiting of school boys for the home *Flak* units of the *Luftwaffe*, previously reported in *Flight*. These *Luftwaffenhelfer* (Air Force Auxiliaries) live in barracks under a definite military discipline. They get up at 7 a.m. and lights go out at 9 p.m. They receive the same food as other *Luftwaffe* soldiers, but instead of wine and cigarette rations they receive sweets and tea.

Paralleled with their military duties they have to continue with their studies; but while they do not study as many subjects as they normally do at school, their curriculum is more intensive to enable them to obtain the school leaving certificate in the prescribed time.

The usual lessons take place on four mornings a week, four hours on two days and five hours on the other two. If a boy cannot maintain the necessary standard he is transferred to a battery manned by a lower form. Military service is carried out daily from 2 p.m. to 4 p.m., followed by an hour of games. The boy auxiliaries receive half the pay of *Luftwaffe* men, e.g., half a mark per day.

Self Denial

JINJIRO MIZUNO, member of the Japanese upper house, has produced a new scheme for collection of funds to provide the Japanese Air Force with aircraft. The plan, which is being sponsored by the Japanese-German-Italian Friendship Society, provides that everyone of the millions of inhabitants of the Greater East Asiatic sphere should contribute a monthly trifle to the fund by giving up some pet habit as his share in the fight for the "new order." Thus three days in the month are to be proclaimed as "tobacco-less," on the other days women should give up cosmetics, etc. No fewer than 10,000 aircraft are expected to be supplied from the funds collected in this manner.

Richthofen

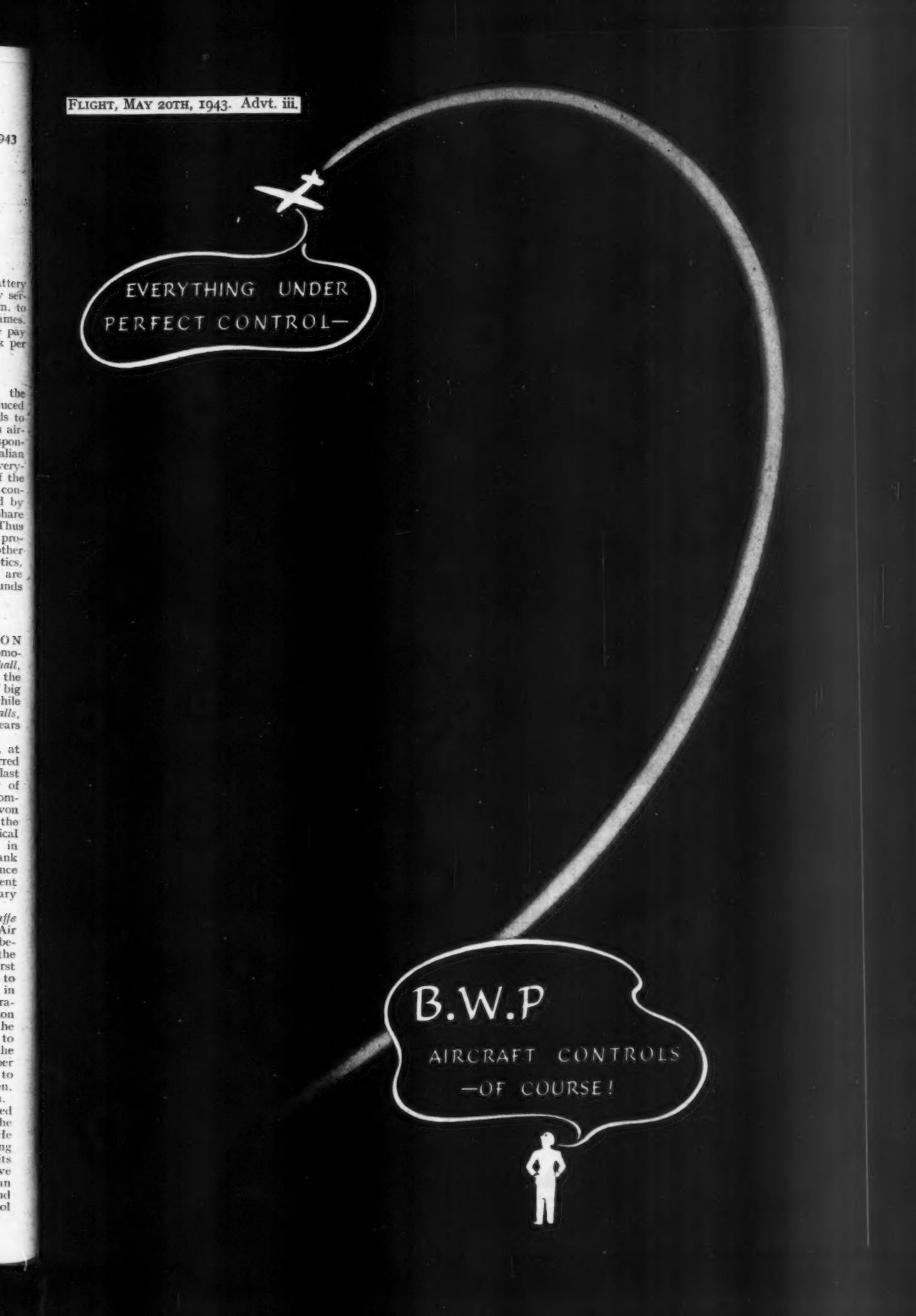
WOLFGANG FREIHERR VON RICHTHOFEN, whose promotion to the rank of *Generalfeldmarschall*, was announced some time ago, is the young man of the *Luftwaffe's* "big three." He is 48 years of age, while the other two *Generalfeldmarschalls*, Kesselring and Sperrle, are both 58 years old.

Richthofen served in the last war, at first with the cavalry, and transferred later to the Air Force. During the last months of 1918 he was a member of Germany's No. 1 fighter squadron, commanded by Manfred Freiherr von Richthofen. In 1920 he rejoined the army and graduated from the Technical College at Berlin-Charlottenburg in 1929. He was then promoted to the rank of Captain and given leave of absence until October, 1932, which time he spent in Italy, presumably studying military aviation problems.

With the reformation of the *Luftwaffe* in 1933 he went to the Reich's Air Ministry, and in January, 1937, he became Chief of the General Staff of the Condor Legion, which went on the first foreign escapade of the *Luftwaffe*, to fight the Republican Government in Spain. His work in the Spanish laboratory earned him Goering's appreciation and rapid promotion; during 1938 he rose from the rank of *Oberstleutnant* to *Oberst*, and then *Kommodore* of the Kampfgeschwader 257, and in November that year he was further promoted to Major General, and succeeded Lt. Gen. Volkmann as O.C. the Condor Legion.

In the present war Richthofen served as G.O.C. of a Flieger Korps, first on the western front, and then in Russia. He is considered to be *Luftwaffe's* leading expert in close combat tactics, and units under his command are said to have contributed substantially to the German break-through of the Maginot Line, and later on to the capture of Sevastopol and the Crimean peninsula.

PEDIGREE MONGREL: Developed from the Macchi-Castoldi MC-72 Schneider Trophy seaplane, the Macchi C-202 single-seater fighter is powered with a German Mercedes-Benz DB 601N engine of 1,200 h.p. and cruises at 300 m.p.h.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Aircraft Types and

STORMOVIK Il-2C

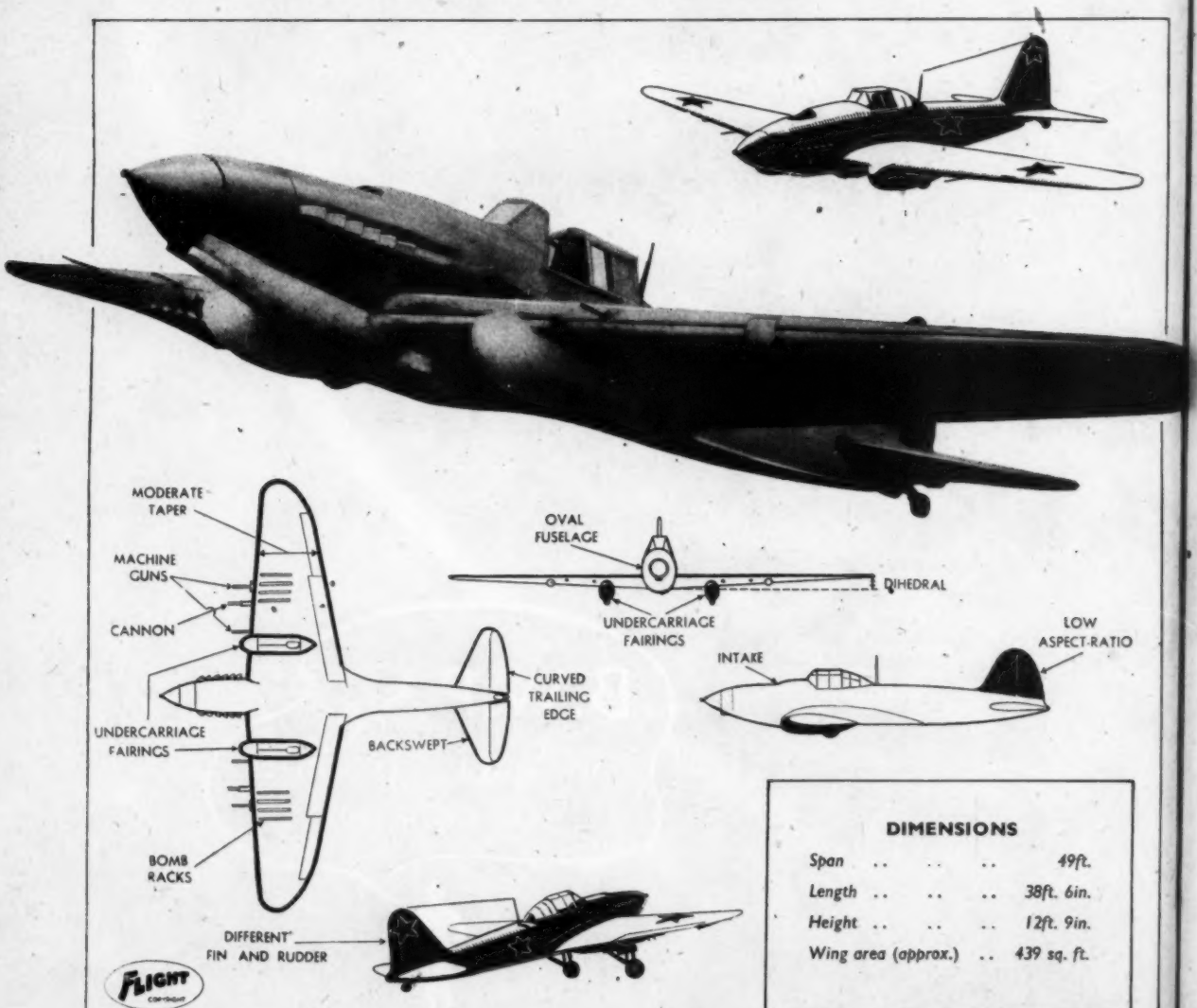
THE aircraft of our Soviet allies have always been the subject of much speculation in this country. The Stormovik (Il-2C), however, is a Russian type about which a fair amount of information has been released for publication, and it is certainly about the best-known type among Russian military aircraft to-day; and although it has often been referred to as a dive-bomber (probably due to lack of precise information on its duties when it was first announced by the Russians) it actually fills the role of low-level attack bomber.

Designed by Sergei Iliuchin, the Stormovik is a single-seater, single-engined, low-wing monoplane of conventional design and appearance. The earlier types were of mixed construction, the wing and front part of the fuselage being of metal and the rear part of wood. The Il-2C, however, is an all-metal aircraft, the fuselage now being a light alloy monocoque structure. Light alloy stressed-skin covering is employed on all surfaces except the ailerons, elevators and rudder.

A prominent recognition feature lies in the rearwardly retracting undercarriage. The twin oleo legs in which the wheels are mounted retract into large streamlined fairings, but the wheels are only partially enclosed by twin hinged doors, their lower arcs being exposed. The cockpit cover forms a hump on an otherwise long, straight back, and a large single fin and rudder is employed. The leading-edge of the wings tapers outboard of the undercarriage fairings, the centre-section being straight, but the trailing-edge tapers right from the roots; the tips are symmetrically rounded. The tailplane is comparatively small and of low aspect-ratio, with a pronounced backsweep to the leading-edge and a slight taper on the trailing-edge.

A particularly interesting feature of the Stormovik is its use as a "rocket bomber" in low-flying attacks. Four bombs of about 250 lb. each are carried on rails under the outer-panels of the wings, and are projected forwards at the ground target.

Two 32 mm. cannon and four machine-guns are mounted in the wings, and the 1,300 h.p. liquid-cooled M-38 12-cylinder "V" type engine is well protected by armour, as is also the cockpit. Top speed is in the region of 280 m.p.h. at 13,000ft.

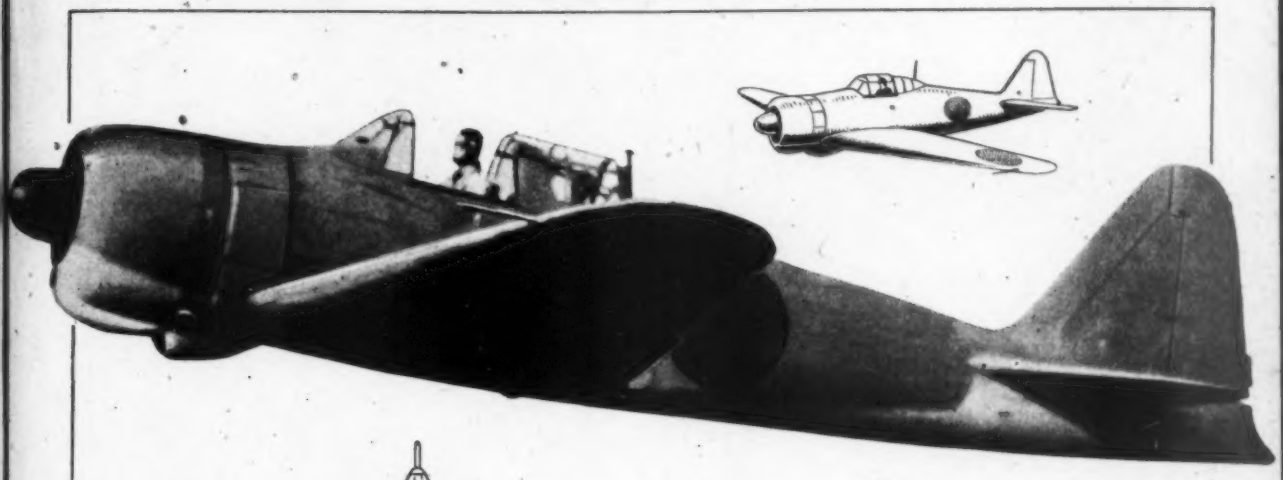


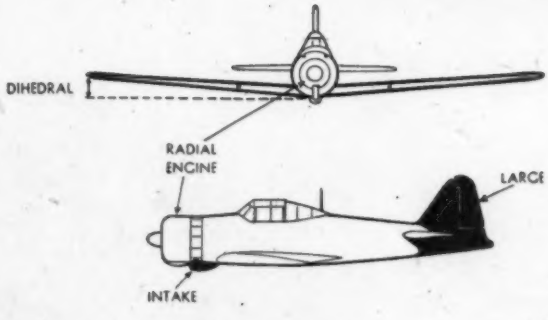
DIMENSIONS

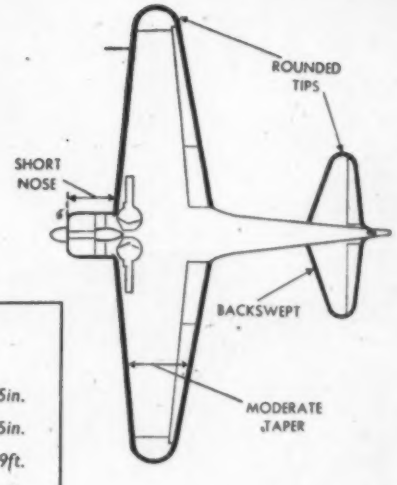
Span	*49ft.*
Length	*38ft. 6in.*
Height	*12ft. 9in.*
Wing area (approx.) ..	*439 sq. ft.*

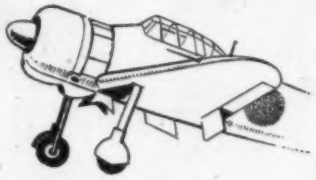
d their Characteristics

MITSUBISHI S-00









DIMENSIONS

Span	39ft. 5in.
Length	28ft. 5in.
Height	9ft.
Wing area	256 sq. ft.

FLIGHT

UNTIL the Americans captured an example of the Mitsubishi S-OO, very little exact information was available about this much-publicised Japanese fighter which the U.S. pilots have nicknamed the Zero.

All that was known before then, apart from the fact that it was a low-wing single-seater fighter powered by an air-cooled radial engine, was gleaned from American pilots, both Navy and Army, who had encountered it in action in various parts of the Pacific theatre. They said that it was very fast, had a particularly good rate of climb, and possessed a degree of manœvrability which made it a highly dangerous opponent in a dog-fight.

Then one day, in the Aleutians, a Zero pilot made a forced landing on some deceptive-looking muskeg, and broke his neck when his aircraft dug its wheels into the soft surface and somersaulted on to its back. In due course U.S. Navy salvage men retrieved the machine and found it was practically undamaged. Being the first ever to be captured intact, this Zero was worth its weight in rubber and was crated and sent to the Naval Air Station on San Diego's North Island, where it was carefully examined

According to reports since published, the U.S. experts were much impressed with several things about the Jap fighter. It was about half the weight of a U.S. Navy standard type of fighter, scaling only 5,200 lb. gross, and was devoid of any protective armour. Its fuel tanks were not self-sealing, and its instruments and other accessories were few and simple. An unusual feature was that the wings were constructed in one with the fuselage, only about 2ft. (just the tips, in effect) folding for carrier stowage. Lightness, with a very low wing-loading, was obviously the chief aim, even the thin alloy skin being coated with only the merest film of rust-resisting lacquer.

Its 1,200 h.p. 14-cylinder Kinsei air-cooled radial engine proved to be a copy of a Pratt & Whitney, and its instruments were also copies of the best American equipment. Excellent workmanship was found everywhere.

Armament comprises two 20 mm. cannon in the wings and two 7.7 mm. machine-guns in the engine cowling. Top speed is 345 m.p.h. at 10,000ft., service ceiling 36,000ft., and normal range 590 miles at 265 m.p.h. Wooden auxiliary fuel tanks are sometimes fitted beneath the centre section.

An Avro Lancaster flying at 10,000 feet on full load test with two port engines stationary

Notes from a Test Pilot's Diary—No. 7

Instruments

Diagnosing Some Puzzling Faults in Oil Pressure Gauges and Airspeed Indicators

By "WITNESS"

ASSEN JORDANOFF, in his entertaining book "Through the Overcast" says: "A plane-load of instruments is not enough if the main instrument is just a hat rack." In test flying the converse of this wisecrack is also true, because no pilot can be expected to diagnose faults speedily if his instruments are inaccurate. What test pilot has not, at one time or another, been led nicely "up the garden" because, unsuspected by him at first, the pressure gauge read 10 lb. low or the A.S.I. was 5 m.p.h. high?

There is in existence, or was until it reached the scrap heap, an oil-pressure gauge which cost an aircraft manufacturing firm rather more than £600 before it was discovered. Interest in the readings of this gauge first arose when a pilot reported oil pressure dropping to below 30 lb. at altitude. Various adjustments were tried, such as screwing up the P.R. valve, changing viscosity valves and oil coolers, and checking for possible leaks in the suction oil line.

All were without avail, so the engine was taken out, returned to the works for strip and detailed examination. Nothing wrong could be found, but in order to make doubly sure of obtaining good results, the makers fitted a special large-capacity oil pump. The engine was then returned for installation and flight. Again the trouble occurred—oil pressure perfect at moderate altitudes, but always falling in the vicinity of 30,000 ft. Eventually in despair they changed the oil-pressure gauge and the whole problem was solved. The reason for the trouble was that a mistake had been made in the specification of the filling fluid for the transmitting line. Consequently, at air temperatures much below −20 deg. C. freezing occurred and the transmitting element lost its fluidity.

Ground Testing A.S.I.

Airspeed indicators have a habit of going wrong even during installation, when unskilled labour may fail to treat instruments with the delicate care which they require. There is room for a good deal of improvement in the methods which we use for ground testing the complete installation of the A.S.I. The problem used to be much easier in the days of the unheated pitot head. Then we could get a rubber pipe on to the pressure head and we knew where we were. But now the electrically heated pitot head with its "permanent leak" into the static side has produced a new problem which has never been successfully solved.

What is really needed is an electrically driven rig which can provide both pressure and depression equivalent to those met in flight on the pressure and static sides of the pitot. These would be registered on a master instrument and attachments provided to slip over the pitot head, thereby communicating the pressure and depression to the pressure and static lines of the aircraft. By this means it would be possible to check the complete installation, including the pitot head, its connections, the lines in the aircraft and the instrument on the dashboard. The nearest approach to this test which can be made at present is to disconnect the pitot head and attach the rig with either a master instrument or mercury column to the ends of the two lines. This is all right as far as it goes, but leaves one guessing as to the integrity of the pitot head itself and its connections when these are remade.

How is the pilot to decide in the air whether the A.S.I. is faulty? If it starts reading backwards at take-off, or stays at 400 m.p.h. whilst gliding in to land, the trouble does not call for skilled diagnosis any more than does an instrument which sticks badly. But if an instrument is suspected of giving a high reading during the approach to land, it is desirable to obtain a check in flight as close to the gliding range of the machine as possible.

Checking Readings

Opinions vary as to the best means of doing this. Some pilots prefer to rely upon taking a snap reading at the moment of landing, and no doubt this is useful so long as one lands consistently in the same manner. On the other hand, such a reading is usually rather far down the speed range, and a nearer approach to the gliding approach speed can be found in the stall with flaps and undercarriage up. For instance, the gliding approach speed range of a typical machine may be 100-120 A.S.I., the indicated stalling speed with flaps and undercarriage up 85 m.p.h., and the touch-down speed on a normal three-pointer 70 m.p.h. From this the advantage of having a check speed some 15 m.p.h. nearer the gliding speed as compared with touch-down will be obvious. Moreover, one can do a number of check stalls without the necessity to take off and fly another circuit to obtain a second reading.

At the other end of the speed range the full-throttle level speed test, which is always done on every production aircraft as a matter of course, should provide evidence if there is serious under- or over-reading at the higher end of the scale.

An unusual trouble which sometimes occurs is an over-reading A.S.I. due to an internal static leak in one of the other instruments on the static line—the rate-of-climb indicator and the altimeter. In this connection the rate-of-climb indicator is probably the worst offender, for I have known two cases of the A.S.I. being cured by changing the rate-of-climb indicator, but the only faults which I personally have found in altimeters have been either sticking of the mechanism at certain heights on the climb, or inaccurately set millibar scales.

R.A.F. SALVAGE NOVELTY

SALVAGE weighing over 25 cwt. was handed in at the pay-box by R.A.F. personnel during a dance and cabaret recently at a Fighter Command station.

Reductions in the price of admission were made according to the amount of salvage each dancer brought. Four razor blades made a reduction of 1d., while a cycle tyre brought the admission down by 3d. During the evening more than 1,500 razor blades were "paid in." Other payments included 4 cwt. of ferrous metal, 7 lb. of toothpaste and other tubes, 20 cwt. of bottles, 28 lb. of mixed paper and a quantity of rubber tyres.

Stratosphere Research

Functioning of the Human and Mechanical System Under Simulated Flight Conditions

PREVIOUS articles in this series have dealt with Fundamental Problems (February 18th), the Effects of Height on the Human Body (February 25th), Pressure-cabin Design (March 4th)

THE development of aircraft for high-altitude flight has made necessary laboratory test equipment which permits the investigation of the co-ordinated functioning of the entire pressurisation system when it is submitted to simulated flight conditions. This means that the flow characteristics and mechanical functioning of the cabin supercharger, the outflow valves, the control unit and the complete duct system must be tested under altitude and temperature conditions from sea level to ceiling, and from normal temperatures to −70 deg. F. In addition, the reactions of pilots and aircrews when flying at high altitudes can be tested under actual conditions and under medical supervision without undertaking actual flight. For the purpose of these latter tests use is made of a decompression chamber, and before describing this equipment, now commonly used both in the Service and by aircraft manufacturers, it is interesting to record how probably the first decompression chamber was brought about.

Tissandier's Adventure

In 1875 the Belgian balloonist Tissandier and two compatriots, Crocé and Sevel, made a famous balloon ascent to a height of 28,800ft. (almost the height of Mount Everest). During this Tissandier put into writing a thrilling and graphic account of his reactions as they ascended. His two companions died, but Tissandier survived, and his account of the ascent inspired the French physiologist Berthou to begin experiments with the use of oxygen, as the result of which he eventually evolved the first decompression chamber. Various types have been utilised for research purposes in most countries for many years, and they have accumulated a great deal of knowledge of man's reactions when flying at high altitudes and of the functioning of equipment under these conditions.

A series of articles under the title of "High-Altitude Flight" appeared in *Flight* some months ago, in which the effects of altitude on the human body were among the problems reviewed. It is not, therefore, deemed necessary to add a further detailed description here.

Through the window the M.O. watches the functioning of the human system under conditions simulating high altitude.

In the R.A.F. extensive use is made of mobile decompression chambers. They do not reproduce the cold experienced at high altitudes, but the pressure of the air in the chamber can be altered at will, enabling three main effects of decreased atmospheric pressure to be demonstrated—anoxia decompression sickness (commonly known as "bends"), and problems of the ears and sinuses. The insidious effects of anoxia can be demonstrated so vividly in the chamber that the official ruling that oxygen must be used "at all heights above 10,000ft. and from ground level when the rate of ascent is 2,000ft. a minute or more" is seen to be no peculiar whim of some distant official, but a wise and necessary precaution.

The standard mobile pressure chamber and equipment as used in the R.A.F.

The decompression chamber used by the R.A.F. is a welded steel tank made from half-inch boiler plate, mounted on a standard Brockhouse five-ton trailer. It is cylindrical in shape, 7ft. 6in. in length and 5ft. 6in. in diameter, with an entrance sealed by an airtight door 3ft. by 2ft. placed at the rear. The inside is lined with white felt to prevent "sweating" and to deaden sound, and there is seating accommodation, oxygen equipment and intercommunica-

tion telephones for six people. Three people sit on upholstered seats on each side of the chamber, each seat being numbered so that the operator or the medical officer conducting the tests can speak to each person without delay, calling him by number over the intercommunication telephone from his observation cabin at the front of the vehicle.

The operator or M.O can watch through thick glass portholes or windows what is going on inside the chamber. In his cabin is a shelf and small folding table; fitted to the wall are the oxygen regulator and the intercommunication plug for each point fixed inside the chamber. Above the door is an emergency air-admission valve to enable those inside the chamber to bring the pressure inside up to that at ground level if, in an extreme emergency, there should be no operator to do this for them. This inlet is of small size, so that even if it is opened fully the chamber will not "fall" more rapidly than 6,000ft. a minute.

To test the chamber for leaks it is "taken up" to a pressure equivalent to that experienced at 25,000ft. without occupants, the motor stopped, oxygen supply cut off, and the flood and exhaust valves fully closed. Any leak into the chamber is shown by the rate of climb indicator showing a descent. The greatest rate of leakage tolerated by the R.A F. is a "fall" of 400ft. a minute from 25,000ft.

The chamber is decompressed by means of a vacuum pump driven either by a petrol engine or an electric motor, according to the type of trailer employed. Both pump and motor are housed on a platform at the rear of the trailer. The engine generally used is a 5 h.p. J.A.P., Model 5, for which a 10-gallon petrol tank is fitted. This allows for 30 hours' continuous running. The electric motor is a 4½ h.p. B.T.H. working with a 400-volt A.C. current, normally using seven amperes.

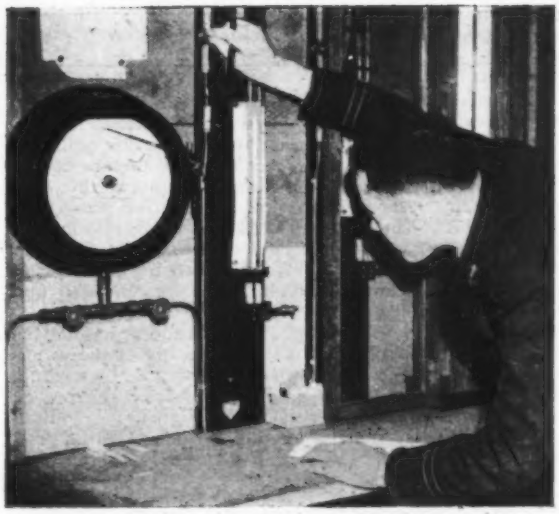
Simulating Climb and Descent

Along each side of the chamber, and enclosed in a wooden box, is a bank of steel cylinders containing the oxygen supply. The lid of this box when open provides a platform upon which observers may stand. The vacuum pump draws air from the lower part of the chamber. The rate at which the pressure is lowered is controlled by an exhaust valve placed in the cabin at the front of the trailer. To increase the pressure to that of the atmosphere air is admitted to the upper part of the chamber, the rate at which this is done being controlled by a flood valve in the control cabin. Exhausting and flooding therefore correspond to climbing and descending in actual flight.

The pressure inside the chamber is not recorded, but the equivalent altitude is registered on an altimeter so placed inside the chamber that it can be watched through the porthole by the operator or M.O. from the control cabin. The speed at which ascent or descent is made is shown on a rate-of-climb indicator placed by the side of the altimeter. The chamber can be exhausted to a pressure equal to a height of 55,000ft. at varying speeds. The maximum rate of climb is 12,000ft. a minute from 0-20,000ft., and the maximum rate of descent is about 30,000ft. a minute from 20,000-0ft.

Since air is exhausted from the bottom of the chamber and admitted through the top, it is possible to keep a constant current of air flowing through the interior by so adjusting the control valves that the volume of air exhausted is balanced by an equal volume being admitted. This constant ventilation is essential; without it a strong concentration of oxygen is soon built up in the small space of the chamber by oxygen "spilt" from the masks. Should engine failure occur, both the exhaust and flood valves are closed immediately to prevent an over-rapid descent.

Personnel sent into the chamber without oxygen are always accompanied by others who use oxygen as a precaution in case of emergency. The Station Medical Officer frequently accompanies his patients into the chamber and checks both pulse and blood pressure during the test. In the majority of subjects, anoxia of gradual onset leads to a gradual loss of consciousness without a serious impairment of the circulation—at least for a minute or two after the loss of consciousness Vomiting may occur at any stage of anoxia, but it is rare. The most likely time is during unconsciousness or immediately after the oxygen has been turned on, during the short period when the oxygen deficit in the blood is being made up.



Checking the equivalent altitude.

The various forms of decompression sickness, including "bends," are usually of gradual onset, but occasionally a person is encountered in whom "bends" develop very soon and develop very rapidly, so that within a space of two or three minutes he is in great pain and on the verge of collapse. Still more rarely, collapse may occur without preliminary pain, or with only trivial pain. It has been found that very rapid rates of ascent and descent produce no discomfort in trained personnel, but in general moderate rates only are employed unless the subjects are known to be unaffected by rapid changes of pressure. Ascent at 3,500-4,000ft. a minute from 0-40,000ft. usually causes no discomfort, but occasionally symptoms of "bends" make it desirable to check the descent. Only exceptionally susceptible subjects develop "bends" in a brief exposure to high altitude.

Altitude and Rates of Change

Experience has shown that most trained personnel have sufficient control of their Eustachian tubes (the tubes leading to their middle ear and ear drums) to descend in comfort at 3,000ft. a minute below 15,000ft. At 30,000ft. or above very rapid rates of descent can be tolerated, as the pressure change for each 1,000ft. becomes less with increasing altitude. Unconsciousness occurs in the majority of subjects at an altitude of between 22,000ft. and 26,000ft. after a period of 35 minutes from the beginning of the run, if the following rates of ascent are used:—0-20,000ft. at a rate of 2,000ft. a minute; 10,000-15,000ft. at a rate of 1,000ft. a minute; and 15,000ft. upwards at a rate of 500ft. a minute.

In order to investigate the problems connected with high-altitude flight and to test thoroughly the mechanical functioning of equipment, etc., many aircraft manufacturers have already realised the necessity of installing both decompression and pressure chambers in their plant. The Lockheed Aircraft Corporation have constructed such a chamber adequate for testing pressurising equipment ranging from the largest sealed-cabin aircraft down to the single-seater high-altitude fighter. This chamber is a cylindrical steel tank 24ft. long by 6ft. in diameter, the shell thickness being ⅜in. It will be seen from the sketch that a steel bulkhead divides the chamber into two equal compartments designated *A* and *B*. Compartment *A* simulates the aircraft cabin, while compartment *B* simulates the atmosphere through which the aircraft flies.

A small circular hinged door, sealed against a rubber gasket, leads from *A* through the bulkhead to a small

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compartment in *B*. This compartment is a replica of a single-seat pressurised cockpit and provides means for testing pressurisation systems as well as for investigating canopy frosting and similar problems. A feature of this door is that it can be opened inwardly or outwardly, thus providing for tests that may require positive pressure in the chamber. The end wall of *B* is a removable flanged head having a smaller auxiliary door in the centre for quick access to units under test. An overhead track and chain hoist provide means for handling the flanged head and heavy test equipment.

Low pressures, simulating high altitudes within the chambers, are obtained by a vacuum pump of the water-cooled multi-vane type, driven at 1,750 r.p.m. by a 5 h.p. motor. This pump is capable of evacuating *A* from an initial pressure of 14.7 lb./sq. in. to 10 lb./sq. in. (absolute), at the same time evacuating *B* from an initial pressure of 14.7 lb./sq. in. to 4 lb./sq. in (absolute) in a period of 7½ minutes.

Automatic Pressure Control

A cam-operated pressure regulator is provided for automatically controlling the pressure within *B* to enable the performance of superchargers and their controls to be checked under variable flight conditions. The cam is motor-operated and adjusts a rubber diaphragm responsive to the pressure with *B*, which operates through a balanced pressure regulator to admit more or less air to this compartment. The proportions of the cam permit a typical flight of 1½ hours' duration and a pressure variation from sea level to ceiling. Flight cams of various contours provide any desired rate of ascent or descent, as well as allowing either a level or an undulating flight pattern at altitude.

Round observation windows (11in. diameter) are installed at strategic points throughout both *A* and *B*, and a small window is provided in the bulkhead for observing the cockpit from *A*. These window panels are arranged in layers to lessen heat transfer and for safety. The inside disc is of ¼in. thick Plexiglas; two layers of ¼in. Plexiglas lie between, with a ¼in. plate glass disc on the outside to prevent scratching. A small amount of desiccant is placed between each layer to absorb any moisture trapped between discs. Clear vision through the windows is afforded under all testing conditions.

Temperature reduction is obtained by a two-stage Freon and dry ice system. The first stage consists of a four-cylinder compressor driven by a 10 h.p. motor, a shell and tube Freon condenser, and extended surface evaporating coils. The second stage is a dry ice-alcohol spray system. The Freon cooling coils are arranged in duplicate with necessary valving to enable defrosting of one coil while the other is in operation. Defrosting is accomplished by valve-controlled water sprays and suitable drains. This switchover can be accomplished without interrupting operations. The valves marked *X* in the sketch are the expansion valves, and those marked *Z* are the shut-off valves. The Freon coils lower the temperature to approximately −10 deg. F., and further cooling is accomplished by the alcohol coil, which can lower the air temperature to approximately −70 deg. F. The temperature is under thermostatic control. During operation the Freon unit carries the refrigeration load to its full capacity, after which the dry ice cooling unit is operated.

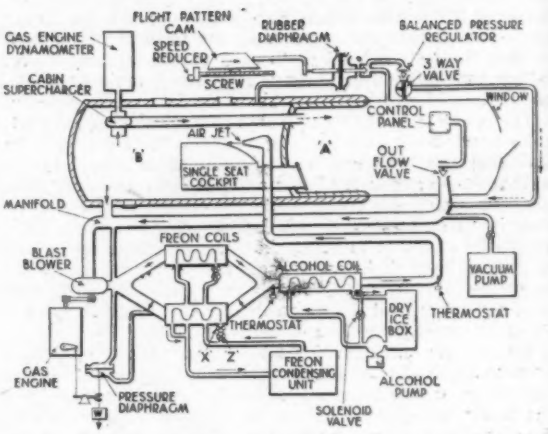
A multi-stage centrifugal blower connected to an air circulation system manifold circulates the air through the cooling coils and *B*. The blower draws the air from the bottom of *B* and passes it through the refrigeration coils to a rotary distributor valve in *B* having three outlets controlled by a shaft which can be operated from outside the chamber. Flexible pipes connected to the valve can be run to any point in *B* which require refrigerated air. Ram velocities up to 600 ft./sec. are made available by this system.

The outside of *B*, and the air ducts running to and from the refrigeration coils, are insulated with 6in. of cork set in asphaltic cement and having a sanded exterior finish. The cork on *B* extends 4ft. beyond the bulkhead to lessen heat flow from *A* and the laboratory air through the shell of the tank. The bulkhead is similarly insulated.

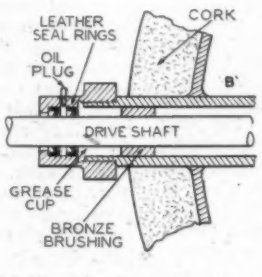
Remote Control

All pressure chamber machinery is operated from a remote control board. The cooling-water flow through the refrigeration condenser and vacuum pump is automatically controlled. On a separate board and table is mounted the usual bank of manometers, potentiometers, and a recording oscillograph for charting instantaneous pressures and temperatures.

When testing the pressurising equipment of the larger aircraft, the supercharger is mounted in compartment *B* and driven by a gas engine by means of a shaft passing through the shell of the compartment. The supercharger receives air from the air blast previously mentioned, which simulates ram effect in flight, and delivers supercharged air to compartment *A*, which simulates the cabin. Pressure



General layout of the Lockheed pressure chamber, 24ft. long by 6ft. in diameter. Compartment A simulates the aircraft cabin while compartment B simulates the atmosphere.



Method of passing the supercharger drive shaft with seat through the shell of the chamber.

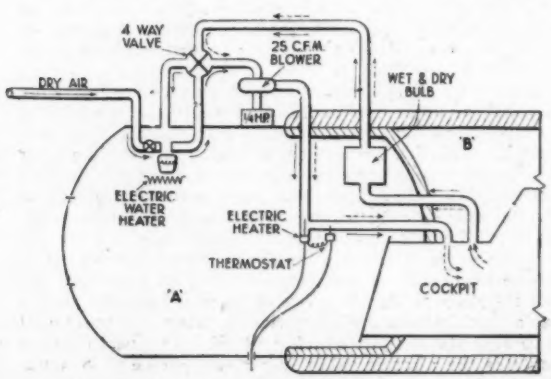


Diagram of piping system ventilating cockpit from chamber A.

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within *A* is controlled by the operation of the outflow valve which adjusts the rate of flow or air from *A* to *B*.

When running tests with pressurising equipment within the cockpit, the *A* chamber may be operated at any pressure between laboratory and cockpit pressure. In this way it is useful as an observation chamber. Flow of air through *A* is controlled by the balanced pressure regulator, which operates in response to pressure variations in *B*. As the vacuum pump draws air from *B*, slight pressure variations actuate the balance pressure regulator, thus causing variations to flow of laboratory air into *A*. This flow causes slight pressure variations, causing the outflow valve of *A* to operate. In this manner the pressures within *A* and *B* are controlled and *A* is ventilated.

In testing the cockpit pressurising system, the supercharger with all of its controls is mounted within the cockpit. The supercharger draws air from *B*, pressurises the cockpit, and discharges overflow back to *B* through the outflow control valve. When running cockpit tests without pressurising equipment within the cockpit, its pressure is that of *A* and is ventilated from that chamber by means of the piping system, as shown in the sketch.

In this system, means are provided for accurately controlling cockpit humidity and temperature so that canopy frosting performance can be explored. The system comprises an air distribution circuit between *A* and the cockpit by a small motor-driven blower. A thermostatically controlled electric heater in the delivery pipe brings the air to the desired temperature. Humidity of the air is regulated by admitting steam to the inlet of the blower. If the air in *A* is too humid drier air is admitted by piping air from the vacuum pump and liberating smaller or greater quantities as required at the inlet to the blower. This air, coming from the refrigeration system of *B*, is extremely low in moisture content. A small electric water-heater provides steam for humidification.

The chamber may also be used for high-altitude pilot training. There is ample room within *A* for three pilots and an attending physician or instructor. Oxygen containers are installed outside, and outlets are provided inside for connecting oxygen masks. A complete intercommunicating telephone system is installed whereby each pilot may converse freely with the outside operator stationed at a convenient observation window. Dual flight instruments are provided inside the chamber and at the operator's station. A sensitive system of valving provides any rate of climb or descent desired by either the observing operator or those inside the chamber.

28 Years a Pilot

Captain H. H. Perry Completes 15,000 Hours

"TOO old at Forty" is an expression not often heard nowadays, but not so very many years ago it was applied to ordinary business men. At that time it was thought, too, that flying was "a young man's game." There have been examples to the contrary—Mr. Douglas Fawcett, for example, who was flying his own Hornet Moth over the Alps until the outbreak of war put an end to that—and wartime operational flying is no occupation for the middle-aged, what with the altitudes at which military aircraft do their stuff, fighter attacks and *flak*.

But fitness as well as age are largely matters of temperament, a fact expressed in the familiar saying that "a man is only as old as he feels." Captain H. H. Perry, A.F.C., of British Overseas Airways Corporation, provides a convincing proof of this. On May 14th he completed 28 years of regular flying as a pilot. The occasion was celebrated at a cocktail party given by B.O.A.C., at which were present many old friends of Captain Perry, directors and members of the corporation's staff, and representatives of the Press.

We on *Flight* first met H. H. Perry when he was one of the pilots of Handley Page Transport in the "early 'twenties." Last week we could not detect any great changes in him. The great-circle course around his equator is a bit longer, perhaps, but it has never been a particularly short one, and as for fitness, he looks a picture of health. His career as a pilot began in the old Royal Flying Corps in 1915, although he had served there as a mechanic for more than two years previous to that, having joined the R.F.C. before the outbreak of World War I.

Capt. H. H. Perry, A.F.C.

After the Armistice Perry joined Handley Page Transport, and afterwards the Aircraft Disposal Co. under Col. M. O. Darby and tested and demonstrated the aircraft of that firm in many countries. In 1927, when A.D.C. closed down, he joined Imperial Airways and remained with it and its successor, the B.O.A.C.

Captain H. H. Perry is a millionaire twice over—in miles, that is, and not in Stirling (so far as we know). He is very rich, too, in friends, all of whom will, we feel sure, wish to join *Flight* in congratulating him on his wonderful flying record and in wishing him all good fortune now that he is setting out on his second 15,000 hours. On July 3rd he will be 51. Don't forget the date, chaps.

AN AERONAUTICAL EVENT

READERS are reminded that this year's Wilbur Wright Memorial lecture, the thirty-first of the series, is to be read on May 27th by that distinguished American, Dr. Edward P. Warner. Dr. Warner will be the twelfth American to read the Wilbur Wright lecture, previous lecturers being Dr. Durand, Commander J. C. Hunsaker, Dr. Ames, Rear-Admiral Taylor, Mr. W. P. MacCracken, Mr. Glenn Martin, Col. Lahm, Mr. D. W. Douglas, Professor von Karman, Dr. Lewis, and Mr. Juan Trippe.

Older readers of *Flight* will need no introduction to Dr. Warner, but for the benefit of the younger generation it may be pointed out that he is vice-chairman of the American Civil Aeronautics Board. One-time editor of our American contemporary, *Aviation*, Dr. Warner has held many distinguished posts in the American aircraft world. He has been a member of the National Advisory Committee for Aeronautics, was at one time lecturer in aeronautics at the Massachusetts Institute of Technology, and is the author of many text-books on aeronautical subjects.

Dr. Warner has that very rare gift of being able to explain aerodynamic problems, not in non-technical language—that would be impossible—but in such clear phrases that even those with comparatively little mathematical knowledge are able to follow him. His subject for the Wilbur Wright lecture will be "Performance and Economy in Transport Aircraft," and our advice to readers is that all who can possibly do so should attend the lecture, which is to be held at 6.30 p.m. at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1.

Readers who are not members of the R.Ae.S. can only obtain tickets through friends who are members.

Air Freight

Some Hard Facts by An American Airline Operator : Railways Not Likely to Go Out of Business

RECENTLY Mr. W. A. Patterson, president of United Air Lines, gave the National Industrial Conference Board some illuminating facts and figures concerning the question of air freight. He appeared to prove conclusively that aircraft are not likely to supplant railways as carriers of American freight. It should be realised that Mr. Patterson, as head of the American airline which has carried more ton-miles of air express and more pound-miles of air mail than any other company, is not likely to be antagonistic. On the contrary. But he set out to bring down to earth those uninformed enthusiasts who believe that shortly the world's freight will be carried by air.

Flight is a firm believer in the future of air transport, but we have always endeavoured to take a sane view. The not-very-well-informed enthusiast can do more harm to a cause by overstatement than any hostile critic because his unfulfilled forecasts will cause disappointment and disillusion those who might otherwise have become strong supporters of the cause. For that reason we feel that English readers should have the opportunity to study and ponder Mr. Patterson's arguments. They are, of course, based entirely upon American conditions, but it would not be difficult to find applications elsewhere.

The key to Mr. Patterson's argument is really found in the following remark: "For the large bulk of commodities, speed in transit is a relatively unimportant consideration. The most important factor is the rate of flow —the laying down at destination of a given number of tons per month."

Mr. Patterson began by comparing the freight train with the cargo aircraft on a basis of normal peacetime conditions. He pointed out that the average freight train would consist of 50 trucks, 30 of which would be carrying 26 tons of freight each, while 20 would be empty. Based on 1940 statistics, such a train could carry 780 tons of revenue-earning cargo. Between Chicago and San Francisco it would give delivery on the morning of the sixth day and could make two round trips in a month. Each month it would deliver a total of 1,560 tons each way.

Train and Air Costs

An oil-burning locomotive would use about 170,000 gallons of fuel oil during the month, which would cost 3,400 dollars. The equivalent of 20 men would work the train. Their total pay would be about 5,000 dollars for the month. The total cost of running the train would be about 50,000 dollars for the month. These figures, therefore, would represent the cost of moving 1,560 tons from Chicago to San Francisco and another 1,560 tons in the opposite direction.

In obtaining comparative costs by air Mr. Patterson took as his basis one of the *Mainliners*, converted for freight-carrying. It would carry 2½ tons on each trip, and so would need to make 626 round trips to transport the 1,560 tons which the freight train did in two round trips. This would represent 2,500,000 air miles compared with the train's 8,800 miles.

Obviously, Mr. Patterson said, a single aircraft could not make 626 round trips between Chicago and San Francisco in a month. He considered 11 round trips reasonable (and remember he spoke from long practical experience). On that basis 57 aircraft would be needed. During the month these 57 aircraft would consume 1½ million gallons of petrol, compared with the 170,000 gallons of fuel oil of the train. The petrol would cost 200,000 dollars, compared with 3,400 dollars for the train's fuel oil. The number of pilots needed would be 400, compared with the 20 crew members of the train. Their pay would amount to 200,000 dollars, compared with the 5,000 dollars of the train crew.

Basing his figures on recorded experience, Mr. Patterson estimated that the total operating costs of the 57 aircraft during one month would be 1¾ million dollars, compared with the 50,000 dollars of the train. In other words, carrying the same freight the same distance by air would cost *35 times as much*!

Mr. Patterson pointed out that this comparison was unfair in that, owing to the long-haul nature of the route chosen as an example, he had given the freight truck 300 miles a day, whereas statistics showed that the actual average for the whole country was only 36 miles a day.

Fuel Requirements

A fair comparison might be made by assuming the present-day type of aircraft to do the work of three freight trucks. Using this figure in examining the suggestion of carrying all America's freight by air, Mr. Patterson said America had something like 1,800,000 freight trucks. On the assumption that one aircraft could do the work of three trucks, that would mean 600,000 transport aircraft. During one year those aircraft would consume 122 billion gallons of petrol, which was 2½ *times more than the pre-war cracking equipment capacity of all the refineries in the world*!

Pilots for the 600,000 aircraft would number 2½ million, and 20 million total airline personnel would be needed to keep the aircraft flying. That was 15 per cent. of America's population, and would be a substantial contribution to the solution of post-war unemployment, if it were not so expensive!

Lest it be thought that the president of the United Air Lines is despondent, let us hasten to point out that he expressed the view that "air transportation is going to revolutionise practically every social and economic viewpoint and practice. In the field of passenger travel the aircraft may well take over a major share of the volume. Passengers as a commodity have a high value per pound and per hour, and require a relatively large amount of cubic space. These factors combine to make the costs of transporting passengers by surface means and by air somewhat more comparable than is the case with other cargoes."

Mr. Patterson summed up as follows some of the conditions that must exist in order to justify shipment of freight by air:—

1. An emergency has to be met.
2. An opportunity must exist for a substantial saving in warehousing and inventory costs.
3. Commodities must have a value per pound sufficiently high to make possible worth-while savings in financial and insurance costs.
4. Surface transport must be inadequate or non-existent.

"THANKS FOR THE BROLLIE RIDE!"

WAR trophies collected by the parachute section of a Lancaster bomber station consist of letters from parents of aircrews who have baled out safely over enemy territory and are now prisoners of war.

Crews who owe their lives to the skill of the airwomen who have packed their 'chutes rarely forget to ask their relatives to write to thank the girls concerned. This particular section has had over half a dozen letters and the officer in charge contemplates framing them and starting a "gallery."

"The airwomen are very proud of them," he added. "It pleases them to know that their careful monthly inspections of these parachutes, as well as the packing, has really saved a life."

Topics of the Day

Whither the Flying Machine?

"Indicator" Suggests That Aircraft Design May Have Taken the Wrong Turning : Essential Simplification in Peacetime Use : The Lost Art of the Rigger : Jet Propulsion Again

THERE are moments—whether rationalistic or idealistic—when one is inclined to look at aircraft and wonder where designers and manufacturers are really going. Just as one sometimes looks at the world of people and wonders, with the same cynical suspicion, where the people are going.

Aircraft must, I feel, return to a somewhat simpler shape if they are not to become intolerably expensive vehicles, both in initial cost and maintenance. Yet it is difficult to see how any sort of simplicity is to be obtained without the loss of the performance for which designers have struggled so hard. Such a return must involve not so much a simplification as a complete change of heart. The flying machine must become something entirely different if it is not to over-complicate itself into extinction like so many of its living counterparts. In the world of the mechanical it will be the survival of the simple rather than the survival of the fittest.

Anyone who has had anything to do with the maintenance of the modern aircraft will know just how many man-hours must be expended in the mere business of keeping them airworthy. Leave any aircraft to its own devices for a couple of weeks or so in a field, duly inhibited, and see how many little things have gone quietly and inexplicably wrong with the thing. For no very obvious reason the rate-of-climb indicator will have developed the most prodigious leak, the directional gyro will have become unreliable, one of the motors will have provided itself with the sort of mag. drop which cannot be cleared in a normal run-up (and that means hours of work on cowlings which won't go back properly and on plugs which cannot be reached without a very patent spanner), and the brake-pressure system will have a mysterious leak. In addition, some unfortunate sparrow may have made its nest in the exhaust manifold of the port engine.

Complex Reliability

Yet when one looks at the stuff that goes into the modern flying machine one is amazed that so little *has* gone wrong in the time. And it must be admitted that any aircraft which is flown day by day tends to be a good deal more reliable than one which is left to itself. Now that the Great Public has heard all about Gremlins the word has become taboo in knowledgeable circles, but it is quite easy to understand how the myth originated—or, rather, why it originated.

How else was it possible to explain the fact that an aircraft which, on its last flight, was absolutely perfect has gone to seed so badly? One day some person must make the simple experiment of parking an aircraft bang over a "fairy circle" for a few days just to see what the Little Men get up to. Gremlins are, after all, only an aeronautically minded branch of the Gnome, or Little Men, or Poltergeist family—and the aeronautically electrically minded Poltergeists must have the best fun of all thinking of the fitter who, on the next day, will press the starter button and produce, not a smart movement of the airscrew (or aircrew), but a painfully strong smell of burning. That is, if the "acc. barrow" hasn't gone mysteriously flat during an all-too-short night in which both the barrow and the aircraft have been continuously watched by a bored and hungry dog.

Flying machines having reached the absolute limit of complication, some bright fellow will eventually act on the perfectly rational idea that it is worse than stupid to make a lot of little explosions to drive millions of mechanical things (and eventually a large fan) when one large explosion, suitably controlled, could quite well do the whole job, leaving the ancillaries to the mercies of a small and simple engine—or even to a little windmill which is driven by the large explosion. And I may add that there is no reason why an explosion should be a sudden one or why its power should not be controlled as accurately as an engine.

Then designers will find that jet propulsion doesn't fit in very well with the present-day shape of aircraft; the thrusts will be in all the wrong places. They may even find that a great deal of the work of controlling can be done by either directing the main jet or by having subsidiary jets blowing off in different directions. It may then be possible to produce something like the ideal "flying wing" so ably visualised by Mr. Geoffrey Smith in last week's issue. On visual judgment alone I'm inclined to think that the flying wing is bound to be an unstable and difficult device so long as an aircraft is driven by a lot of separate engines, but the basic alterations in design which will be inevitable on the introduction of some kind of jet propulsion may make this shape a much more practical one.

Back to Pushers

The tailless or back-to-front type *is* only possible with pusher arrangements, and at present the cooling and other difficulties are far too great to make this practical. It's all very pretty to have "flat" engines buried in a wing and to have airscrews working in more or less free air, but the plumbing and shafting problems make this an impractical scheme at the present time, whereas a jet would necessarily be pushed out somewhere behind the aircraft. Another little point which is often overlooked by the pusher exponents is, at least in wartime, that the unfortunate crew stand at least a fifty-fifty chance of being cut to pieces by the screws when and if they have to bale out; the Japanese may like that sort of hari-kiri ending, but not the palefaces. Long ago, at the Paris Aero Show, I remember looking, I think, at the Fokker fighter and wondering how on earth the pilot was expected to leave the thing in the air.

Talking about parachute departures, the Americans have yet to consider this point as seriously as they should in all their types. Like their ideas of armament and, particularly armour-plating, in the earlier days of the war, this failure was the result of peacetime thinking. Although we were behind in a lot of ways, our military aircraft, even in peacetime, were severely practical in such respects. We learnt a whole lot about armour and bullet-proof tanks in the first six months of the war, but "get-outability" was always considered by our designers. In one or two first-line American types the pilot, at least, can have very little chance unless the aircraft is hit when flying at some stratospheric altitude.

Simplicity is all the more important in civil machines flying in peace, because no firm—except one of the international thousand-million-pound affairs—could possibly afford the cost of maintenance and replacement in some present-day aircraft. Nobody takes very much notice now if a machine has to be belly-landed because a hydraulic pipe-line has gone, or if an engine is wrecked through the effect of "hydraulicing" following the failure to turn it round by hand during a rush start. I remember watching a gang of particularly dim fitters, in the early days of the war, starting an American engine for the first time; accustomed to starting British engines, they proceeded according

WHITHER THE FLYING MACHINE?

to their usual plan. Not until the engine had been locked up solid did the onlookers realise that they had been starting in "rich" rather than "cut-off"; I believe a con.-rod went when one of the cylinders inevitably filled up with neat fuel—which is virtually incompressible.

But, as I've said before, the wonder is not that modern aircraft are difficult and expensive to maintain so much as that they are so very reliable in ordinary use and when looked after by a lot of partially trained fitters and riggers. They are saved, very largely, by the magnificent work of the compilers of "volumes" of different kinds, and by the vast quantity of safety-first bookwork which goes with every effort of maintenance. If the books are read and understood, and if all the people concerned conscientiously fill in all the columns on the pieces of paper, mistakes should be impossible.

Metal construction has removed most of what used to be a rigger's work—which consists largely now of a host of other jobs on such items as hydraulics and brakes. The present-day rigger is generally lost when he is faced with some serious rigging work on a flying machine of the old type, with wires, and struts, and braced centre-sections. Things either fit or they don't and the parts are returned. So many bits are made by so many different people that it is not unusual for ailerons, for instance, to be found a bit too long or too short for a particular machine.

And is it difficult to make a present-day rigger understand trim? In his opinion all aircraft should be the same shape and size, since they come off the same jigs, and when anyone announces that a particular machine is, say, left wing low, he will proceed, perhaps, to juggle with the control cables, forgetting that all control surfaces must find their own "hands-off" level, and that any such juggling merely moves the relative position of the control itself in relation to these surfaces. It is not possible to make him see that the movement of, say, an aileron tab must necessarily raise or lower the ailerons during "hands-off" flight, so that the column or wheel is lopsided. That is what a tab is for—the aileron does the actual work of holding up the wing and the tab is merely saving the pilot a little muscular effort; either he or the tabs can hold the column over a little. Only the other day someone seriously suggested that a machine might be tail-heavy because the neutral position of the control column didn't coincide with the neutral position of the elevators—just as if the pilot *held* the thing in the neutral position.

The basic misunderstanding is caused by a failure to realise what control surfaces actually do; the expression "left wing low" is a complete misnomer for the benefit of earthlings. Each and every control movement causes a displacement in the axis concerned, and the displacement is continuous as long as the control is held over. A left-wing-low machine would, if left to its own devices, do a slow roll to the left; and a tail-heavy aircraft would eventually, other things being equal, do a loop.

And so it goes on.

"INDICATOR."

Book Reviews

"Basic Calculations for R.A.F. Ground Duties" (Fitter Trades), by A. E. Druett, B.Sc., A.M.I.Mech.E. Isaac Pitman and Sons, Ltd. Price 3s. 6d.

THIS course in arithmetic for the practical mechanic is an excellent contribution for all who are prepared to devote some spare time in an attempt to qualify for the higher grade. By simple, yet practical, methods the student is led from fractions to decimals, formula and equations, mensuration of the circle, measurement of angles, etc. Practical examples follow each chapter with solutions whereby the student may check his progress. Cadets of the Air Training Corps will find the syllabus for the proficiency examination adequately covered.

Libyan Log. By Squadron Leader Eain G. Ogilvie. Oliver and Boyd, Ltd. 5s. net.

ONE of the marvels of Gen. Montgomery's long and rapid pursuit of Rommel was the way in which the Western Desert Air Force contrived to keep pace with the Army. It had been practising rapid movements some time before the advance from Alamein, and this book gives some account of how it was done. The author is a Public Relations officer who was attached to a Fighter Wing H.Q. in the Western Desert from July, 1941, to July, 1942. His job was to give the British public some idea of what was happening in the desert, either directly or by putting war correspondents on to the job. Some of the tales he tells have already appeared in print in papers in Britain. This book, however, is mainly a personal record, and it gives a very good idea of what the men in the desert went through—their hardships and their occasional simple delights, and so on. The log is full of interest, and the book is very well worth the modest sum of five shillings.

Roof Over Britain. The Official Story of the A.A. Defences 1939-1942. Prepared for the War Office and the Air Ministry by the Ministry of Information. H.M. Stationery Office. 9d. net.

THE whole country was thrilled by the official publication, *The Battle of Britain*, which told the heroic story of the fighter squadrons which defeated the German attempt to conquer Britain by air action. But Fighter Command did not rely in this battle solely on Hurricanes, Spitfires and Defiants. A great part in the victory was played by the A.A. guns, the searchlights (both provided by the War Office), and the Royal Observer Corps and the Balloon Command (both provided by the Air Ministry).

This book fills the gap by telling the story of these three organisations. In the first two years of the war the A.A. guns brought down 600 enemy aircraft, and three times they shot down over 50 in a week. They also did incalculable service by pointing out raiders to the squadrons in the air, as it is easier to spot aircraft from the ground than from the air. At times the gun positions had bad times and comparatively heavy casualties, but the officers and men stood up to them with all the gallantry of British soldiers.

Each of the four bodies concerned gets its fair share of attention in this book, and the reader learns that there has been valour and also some of the glamour of war in duties which he may have thought were merely dull routine work. In particular, a very good account is given of the W.A.A.F. work in taking over a large part of the balloon barrage. The book is adequately illustrated and is excellent value for its trifling cost.

Heat Treatment of the Wrought Aluminium Alloys.—Part 1. Published by The Wrought Light Alloys Development Association, Union Chambers, 63, Temple Row, Birmingham, 2.

HEAT treatment of wrought aluminium alloys has been a problem to numerous sub-contractors who have suddenly had to cope with this practice on switching over to aircraft production, and little authentic information has been published upon the subject. This booklet, therefore, though rather belated, does fill a long-felt want, inasmuch as it is primarily intended for the non-technical personnel in the works to assist in overcoming production problems, which it should do admirably.

This particular bulletin deals essentially with the practice of heat treatment where the necessary plant is available; a further booklet in preparation deals with the essential equipment—Part 2, Equipment. Included in the booklet are notes upon quenching, ageing, annealing, workshop practice and basic principles of heat-treatment with a bibliography which will enable those wishing to pursue the subject further to do so.

Copies are available to all interested personnel gratis upon application to the Association at the above address, and specific difficulties or problems will be dealt with through the Advisory Service Bureau. Such valuable information from such an authoritative source should be in the possession of all engaged upon this work.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

SAILPLANE EFFICIENCY

Designer Seeks Expert Opinion

CAN any reader give me an idea as to the efficiency of a sailplane I have begun to design? The main figures for it are:

Weight, 400 lb.; span, 44ft. 8½in. (net); cruising speed, 50 m.p.h.; sinking speed, 2.4ft. per sec.; landing speed, 20 m.p.h.

I believe it to be good, but would like an expert opinion on it. These are not desired qualities. They are realised qualities.

J. R. LAWSON.

BENDING BLADES

Effect of Impact with Ground

RECENTLY in *Flight* there have been photographs by airscrew manufacturers of aircraft which have flown low enough for their airscrews to touch the ground. In every case all the blades have been bent back. Now this simple fact puzzles me as, by my reasoning, they ought to be bent forward.

The airscrew of an aircraft flying in still air has the effect of forcing the air back, not only in relation to the aircraft but to the rest of the air. Now, if the air is forced backwards relative to still air, and to the ground, then if a blade were to strike the ground and try also to force it backwards, then the blade would be bent forward, as the earth would refuse to be pushed back like its neighbouring element, the air.

I expect some other readers could explain where my reasoning breaks down.

D. H. FARLEY.

BOOST PRESSURE VARIATION

Clue from Normally Aspirated Engine

I HAVE been reading with interest some of the views presented by readers of *Flight* concerning boost pressure rising when an airscrew is changed from fine to coarse pitch. The pet argument seems to lay the blame on either the supercharger or the type of engine.

I can give an example of increased manifold pressure in a normally aspirated engine, and this engine is the Gypsy Queen installed in a Proctor.

The Proctor is fitted with a two-bladed V.P. airscrew, and when the engine is running at approximately 1,800 r.p.m. in fine pitch, the manifold pressure is 9 lb. per sq. in. absolute, but when the airscrew is changed to coarse pitch the pressure rises to 12 lb. absolute, and stays there until the airscrew is changed back to fine pitch.

I am writing this in the hope that it may throw some light on the subject of boost variation, and I also hope that one day I may read that a successful conclusion has been reached.

J. WARD.

POST-WAR AIR PLANS

Suggested Preliminaries

ON the important subject of post-war commercial aviation, may I submit a few views on the matter, hoping that in tearing them to shreds some critic may find something of practical value?

First, the Government should immediately try to come to an understanding with the Allied Governments, especially America, on the running of post-war air lines, existing and proposed, so that some idea of aircraft requirements and the necessary companies can be obtained.

At the Government's expense an "Aircraft Research and Design Bureau" should be set up as soon as possible, consisting of aircraft designers, stress-merchants, and all the other necessary technicians, including air-line representatives, whose work would be to evolve the most efficient aircraft possible, based on the information obtained from the Allied discussions. The Bureau should include representatives of all the aircraft firms who have projected designs for commercial aircraft, so that these designs could be carefully considered. Also, all aircraft patents should be considered, with a view to incorporating them in the designs, and invitations extended to all firms who consider they have products which could be used to advantage, and to the public in general who may have ideas which they consider practical.

As any military aircraft designs started now would not be in production before the end of 1945, when the war should be over, it would not be detrimental to our war effort to transfer a small percentage of the country's aircraft technicians on to commercial projects.

When the completed designs have been drawn up, experiments and research carried out, and prototypes built for flying experiments, the final drawings could be made and everything prepared for peace-time production.

As soon as war production ceases, a percentage of the labour can be retained for commercial production, this percentage being those most suitable for the aircraft industry and who are genuinely interested in the future of aviation.

The manufacture of the aircraft can be split up, each firm receiving a part most suited to it. These planes will have to be built, so why not start immediately war production ceases and ease the problem of unemployment?

Regarding the necessary materials for manufacture, all these will probably be available from the huge surplus of Government contracts. Besides materials, there will be standard items, such as engines—of the "power-egg" type—radio and wireless equipment, flying instruments, hydraulic equipment, landing gear, tanks, etc., and countless millions of nuts, bolts, rivets, and other small parts, which might otherwise become practically a dead loss. Thus the cost of the aircraft need only be labour, plus luxury equipment, royalties on patents, etc.

The finished aircraft could then be sold to the air lines at the low cost of manufacture plus a small profit for the manufacturers. This cost should be originally borne by the Government, the air lines paying off the cost at approximately 20 per cent. of their yearly net profit until payment is completed.

This arrangement would prove very beneficial to new companies just starting operations, and show willingness on the part of the Government to help in making British air transport the best in the world.

DONALD H. LORD.

TIN OPENERS

Need for Rapid Conversion

SINCE your correspondent "Student" has asked for opinions on his Airacobra *v.* Hurricane IID tank-busting theory (*Flight*, May 6th), I would like to state the following points:

The fitting of a 40 mm. cannon in the Airacobra should be a comparatively simple matter, as the machine was originally designed to accommodate a 37 mm. weapon, and, I believe, has been in action in Russia with a gun of this calibre.

However, weight of fire is the decisive factor, and the Airacobra's single cannon would hardly compare with the Hurricane's two, although the former machine, with its main weights distributed about the centre of gravity, should possess better flying qualities than the latter. It should be remembered, though, that tank-busters were urgently required for the Middle East campaign, and therefore the obvious choice would be a high-performance aircraft which could be rapidly converted. The Hurricane IID is evidently the best compromise.

P. W. WELCH.

Hurricane IID versus Airacobra

WITH reference to the letter of "Student" in your issue of May 6th, though the layout of the Airacobra presents a good position for a centrally mounted cannon, it is not an ideally suitable aircraft for fitting a 40 mm. cannon.

First, the Airacobra does not come anywhere near the standard of the Hurricane for all round efficiency and reliability, although its top speed may be greater. The fitting of the cannon to the Airacobra would present difficulties, the barrel would have to extend well in front of the spinner to enable the cannon to be accommodated; this would probably bring it too far forward, with consequent bad effects on the balance of the aircraft. Lastly, I cannot think how the Airacobra is well suited to African conditions as regards its undercarriage which, unless I am mistaken, with its rather frail nose wheel necessitates runways for take-off and landing, whereas the Hurricane can use very rough and ready forward landing fields—a factor which cannot be overlooked.

Another obvious drawback is that the Airacobra could only carry a single cannon and not two, as on the Hurricane IID.

WILLIAM B. RICHARDSON.

[An improved version of the Airacobra is being produced in America. Details may not be given, but great things are expected of the new model.—ED.]

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Promotion

GENERAL DUTIES BRANCH

Air Comdre. C. R. STEELE, D.F.C., to be Act. Air Vice Marshal. May 1st, 1943.

Retirement

MEDICAL BRANCH.

Air Vice-Marshal W. TYRELL, C.B.E., D.S.O., M.C., M.B., B.Ch., D.P.H., is placed on retired list and continues to be employed on Air Force service.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards:—

For bravery and distinguished services during the operations which led to the landing of the Allied Armies in North Africa:

Distinguished Service Cross

Temp. Sub. Lt. (A.) R. M. CROSSLEY, R.N.V.R.

FOR bravery and skill in many air operations against the enemy:

Distinguished Service Cross

Lt. (A.) M. W. RUDOLF, R.N.
Temp. Sub Lt. (A.) M. MARSTON, R.N.V.R.
Temp. Sub. Lt. (A.) E. F. PRATT, R.N.V.R.
Temp Sub. Lt. (A.) W. S SIMPSON, R.N.V.R.

Distinguished Service Medal

Act. P/O. G. DODWELL.

Mention in Despatches

Lt. (A.) L. J. KIGGELL, D.S.C., R.N.

FOR great bravery in air operations against enemy submarines and shipping:

Mention in Despatches

Lt. (A.) D. M. JERAM, R.N.

(Posthumous)

Temp. Lt. (A.) M. H. STAPLETON, R.N.V.R.
Temp. Sub. Lt. (A.) G. W. CRITOPH, R.N.V.R.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Bar to Distinguished Service Order

Act. Wing Cdr. G. L. CHESHIRE, D.S.O., D.F.C., R.A.F.V.R., No. 76 Sqn.—Since the award of the D.F.C. on March 7th, 1941, Wing Cdr. Cheshire has completed further operational sorties. Throughout his long and exceptionally distinguished flying career most of the credit for his squadron's outstanding efficiency and success has been due to his example. His magnificent achievements have been amply proved by photographic evidence.

Distinguished Service Order

Wing Cdr. O. A. MORRIS, No. 218 Sqn.—This officer has commanded the squadron since October, 1942. In November, 1942, he was detailed for a special operation. One engine of the aircraft failed when he was still 50 miles from the target. Being fully aware of the importance of his mission, Wing Cdr. Morris proceeded to fulfil his obligation in spite of all obstacles. On the return journey trouble was experienced with a second engine, but although at times it was necessary to fly at only 200 feet, he flew the aircraft successfully to base.

Act. Sqn. Ldr. E. L. BAUDOUX, D.F.C., No. 233 Sqn.—This officer has completed a second tour of operations. He has made two excellent attacks on U-boats. On the first day of the North African operations he undertook a flight, dropping leaflets. This officer has always undertaken the more dangerous and unpleasant tasks.

Act. Sqn. Ldr. W. M. DIXON, D.F.C., R.A.F.V.R., No. 76 Sqn.—Since being awarded the D.F.C. Sqn. Ldr. Dixon has completed operational sorties. These include one to Berlin, two to the Ruhr, and a low-level attack on Flensburg; during all these operations severe anti-aircraft opposition was encountered. He has invariably remained in the target area until satisfied that he had achieved his object. On one occasion, whilst on the way to Wilhelmshaven, his port outer engine failed. Undeterred by this or by the fact that the aircraft was losing height, he pressed home his attack and bombed the target successfully.

P/O. E. R. LACEY, R.A.F.V.R., No. 90 Sqn.—This officer has served almost continuously on operations since July, 1940. Until January, 1941, he operated against enemy shipping. Since then he has been engaged in attacks on many of the most heavily defended targets in Germany and enemy occupied territory.

Group Capt. E. G. OLSON, R.N.Z.A.F.—Group Capt. Olson is a most experienced pilot who has completed nearly 4,000 flying hours. Until August, 1942, he was in command of a squadron, where he frequently took part in operations. Since then his wide knowledge of flying and firm but tactful handling of men have been displayed most effectively in command of a Bomber Station.

Act. Wing Cdr. A. L. G. HUBBARD, D.F.C.—From November, 1941, to September, 1942, this officer was in command of a squadron which during that period did excellent work. In his present unit he has been successful in building up an extremely efficient organisation in a short time. His keenness and enthusiasm were particularly in evidence in January, 1943, when he took part, as captain of aircraft, in raids on Berlin. On the second occasion he landed his aircraft at base by means of beam approach during a thick fog.

Bar to Distinguished Flying Cross

Act. Wing Cdr. M. J. B. YOUNG, D.F.C., No. 540 Sqn.—Since being awarded the D.F.C., Wing Cdr. Young has completed 36 sorties. For the past nine months he has commanded a flight.

Act. Sqn. Ldr. W. I. DEAS, D.F.C., R.A.F.V.R., No. 61 Sqn.—Throughout two operational tours, this officer has consistently displayed notable determination in locating his target On two occasions he made two runs over Bremen in spite of heavy opposition and on the second occasion descended to 8,000 feet to release his bombs.

Act. Sqn. Ldr. J. L. MARTIN, D.F.C., R.A.F.V.R., —Since the award of the D.F.C., this officer has completed further operational sorties, most of which have been attacks on distant and heavily defended targets. His great skill as a navigator and his keenness to participate in operations have been exceptional.

Act. Sqn. Ldr. C. B. MORTON, D.F.C., R.A.F.V.R., No. 12 Sqn.—Since being awarded the D.F.C. in July, 1942, Sqn. Ldr. Morton has taken part in further operational sorties. These attacks have been against the enemy's most heavily defended targets, including Berlin, Hamburg, Duesseldorf and Essen. In August, 1942, while returning from a raid on Kassel, his aircraft, which had previously been badly damaged, was attacked by an enemy night fighter and his front gunner wounded. The following night, on the homeward journey from Saarbrucken his bomber was again attacked for 15 minutes when the enemy aircraft caught fire and broke off the engagement. On five other occasions this officer's aircraft has been damaged by anti-aircraft fire.

Act. Flt. Lt. C. K. SILCOCK, D.F.C., R.N.Z.A.F., No. 44 Sqn.—This officer has displayed consistent coolness and deliberation in the planning and great determination in the execution of his tasks. He participated in a raid on Stuttgart in November, 1942, flying low throughout the whole journey. During the return flight he successfully machine gunned six trains.

Distinguished Flying Cross

Wing Cdr. M. D. CRICHTON-BIGGIE, No. 83 Sqn.—Wing Cdr. Crichton-Biggie has commanded his squadron since 1942, including the period of intense activity in the summer and autumn of that year. He has himself taken part in sorties against targets in Germany, Italy and occupied territory.

Sqn. Ldr. G. H. D. EVANS, No. 489 Sqn.—This officer joined his present squadron having 38 attacks against enemy-occupied ports to his credit. Since then he has undertaken 16 anti-shipping strikes. In January, 1945, he led a formation of aircraft engaged in a patrol off the Norwegian coast. Although visibility was poor, an enemy transport was sighted. The formation attacked and, seven minutes later, the vessel was seen to be sinking.

Act. Sqn. Ldr. D. S. JACOBS, R.C.A.F., No. 420 (R.C.A.F.) Sqn.—Sqn. Ldr. Jacobs has a fine operational record. He has participated in attacks on the enemy's most heavily defended targets, including Essen, Bremen Hamburg and Cologne. On one occasion during an operational sortie against a target in Italy, his rear turret became unserviceable, when far across France. With his aircraft almost defenceless this officer proceeded on his mission and successfully bombed the target. Again, on another occasion, when crossing the coast on the outward journey to Hamburg, Sqn. Ldr. Jacobs' aircraft was engaged by intense anti-aircraft fire for 40 minutes; with great determination he flew on and completed his mission.

Act. Sqn. Ldr. W. E. ALLISON, No. 424 (R.C.A.F.) Sqn. R.A.F.V.R.—This officer, who is serving on his second tour of operational duties, has taken part in attacks on many of the enemy's most heavily defended targets, including Berlin, Cologne, Brest, Kiel, Essen and Hamburg.

Act. Sqn. Ldr. F. A. GREEN, No. 109 Sqn.—Sqn. Ldr. Green has taken part in 41 sorties. On these operations he has shown a high degree of skill as a pilot, thus obtaining very accurate results despite opposition from enemy defences.

Act. Sqn. Ldr. A. E. HILDITCH, R.A.F.V.R., No. 53 Sqn.—Sqn. Ldr. Hilditch has served in the squadron for nearly two years. During the period he has been regularly employed in night bombing of land targets, in shipping strikes and in anti-submarine patrols. Amongst other successes he has made two determined attacks on U-boats.

Act. Sqn. Ldr. G. F. JACOBSEN, R.C.A.F.—This officer completed a number of operational sorties with No. 218 Sqn. prior to November, 1941. From November, 1941, till September, 1942, he acted as navigating officer to No. 75 Sqn. and took part in further operational missions. He was then appointed station and later group navigation

Air Chief Marshal Sir A. Harris, A.O.C. in C. Bomber Command, recently visited bomber stations in the North of England. He is seen here (right) with Air Commodore G. A. Walker, D.S.O., D.F.C. (left) who controls three bomber stations. In the centre is Air Vice-Marshal C. R. Carr, C.B.E., D.F.C., who will be remembered for his exploits in the long-distance Hawker Horsleys of 1927.

officer. While on operational duties Sqn. Ldr. Jacobsen participated in attacks on many of the most heavily defended German targets, including two attacks on Berlin.

Act. Sqn. Ldr. L. H. KAY, R.A.F.V.R.—This officer has a long record of operational flying, commencing in 1940, when he served as an air gunner. One night in July, 1940, when returning from operations, his aircraft was attacked by two Me 110s and the second pilot killed. The cool, collected directions given by Sqn. Ldr. Kay enabled his captain to manœuvre the aircraft into a position from which a burst of fire from Sqn. Ldr. Kay's guns destroyed one hostile aircraft within five seconds and badly damaged the other. Later as gunnery leader this officer took part in ten operations, always flying with the least experienced crew.

Act. Sqn. Ldr. T. C. P. MAXWELL, R.A.F.V.R., No. 53 Sqn.—This officer has done valuable work in several theatres of war. He is an exemplary flight commander, coaching his flight to a high standard of operational efficiency. He has been engaged mainly on anti-submarine activities.

Act. Sqn. Ldr. H. C. MITCHELL, R.A.F.V.R., No. 156 Sqn.—This officer has taken part in numerous operational flights, against targets in Germany and enemy-occupied territory. Since August, 1942, he has been employed on instructional duties, and is responsible for the training of navigators, in which he has been most successful.

Act. Sqn. Ldr. R. A. NORMAN, R.A.A.F.—Sqn. Ldr. Norman is a courageous and skilful captain of aircraft, who throughout his many operational sorties has shown outstanding keenness and determination.

Act. Sqn. Ldr. J. H. SEARBY, No. 106 Sqn.—This officer has displayed marked determination in locating and bombing the target with precision. His leadership and courage are exceptional.

Act. Sqn. Ldr. J. A. TEMPERLEY, No. 103 Sqn.—Since commencing duty with this squadron, Sqn. Ldr. Temperley has set a fine example to other captains. Under a calm and retiring manner he has a fine fighting spirit, and invariably completes his task fearlessly and with cool determination.

Act. Sqn. Ldr. G. H. WOMERSLEY, D.S.O.—Since the award of the D.S.O. this officer has completed additional operational sorties. On every occasion he has displayed a remarkable consistency in pressing home his attacks with grim determination and courage of a very high order.

Flt. Lt. E. H. BROOKS, R.A.F.V.R., No. 502 Sqn.—This officer has been engaged on convoy escorts, anti-submarine patrols and shipping strikes. He has made four attacks on U-boats, one of them in very poor weather.

Fine Navigation

Flt. Lt. R. C. CUSSONS, R.A.F.V.R., No. 541 Sqn.—Since the beginning of February, 1942, Flt. Lt. Cussons has been engaged on reconnaissance, often in the face of considerable enemy opposition. Many of these operations were over the Norwegian coast, involving long flights over the sea and calling for fine navigation, endurance and courage.

Flt. Lt. G. R. HAY, R.A.F.V.R., No. 51 Sqn.—This officer, who is serving on his second tour of operations, has always made his attacks with great skill and courage, frequently in the face of strong opposition, and invariably with a complete disregard for his personal safety.

Flt. Lt. E. D. L. LEE, No. 543 Sqn.—Flt. Lt. Lee has been employed on reconnaissance since October, 1941, during which time he has flown on sorties over Norway and North-west Germany with excellent results.

Flt. Lt. G. H. MELVILLE-JACKSON, R.A.F.V.R., No. 248 Sqn.—This officer has destroyed at least four enemy aircraft. In August, 1941, when stationed at Malta, he made several low-level attacks on enemy gun emplacements with excellent results.

Flt. Lt. H. R. PUPLETT, R.A.F.V.R.—During September, 1942, while engaged on a meteorological flight, this officer attacked and severely damaged a Fw 200. Later in November, 1942, when engaged on a similar flight, one engine of his aircraft failed at a height of 20,000 feet. All unwanted equipment was jettisoned and Flt. Lt. Puplett, with cool determination and flying skill, brought the aircraft safely back to base.

Flt. Lt. E. A. STONEY, R.A.F.V.R., No. 50 Sqn.—As squadron bombing leader, this officer has displayed exceptional initiative. He took part in numerous raids on the most heavily fortified targets in Germany and Italy, and also in the daylight raids on Milan and Le Creusot.

Flt. Lt. W. J. WINTER, R.A.F.V.R., No. 214 Sqn.—Since October, 1942, this officer has taken part in many operational sorties against targets in Germany, the occupied territories, Egypt, Greece, and Albania. As rear gunner, he has participated in two attacks on Berlin and three on Hamburg. On two other occasions, while attacking at low level, he set fire to enemy aircraft on the ground and inflicted damage on enemy troop convoys.

Act. Flt. Lt. J. W. BELL, R.C.A.F., No. 425 (R.C.A.F.) Sqn.—The operations completed by this officer include several attacks on such difficult targets as Essen, Hamburg, Bremen and Dusseldorf. On every occasion he has displayed a high degree of courage, skill and initiative.

Act. Flt. Lt. R. H. G. BOOSEY, R.A.F.V.R., No. 408 (R.C.A.F.) Sqn.—While serving as an operational pilot, Flt. Lt. Boosey has displayed courage and coolness of a very high order. He has participated in sorties against such targets as Bremen, Dusseldorf, Kassel, Lorient, and in numerous mine-laying missions. He has on several occasions brought back excellent photographs of the aiming point. In February, 1943, when about to land, after an attack on Cologne, his port outer engine caught fire and the port inner engine stopped when the aircraft was at a height of about 300 feet. Flt. Lt. Boosey, with great skill and coolness, kept the aircraft under control and climbed to 900 feet, where the crew baled out safely. With complete disregard of his personal safety, the pilot then made a successful crash-landing.

SERVICE AVIATION

Conspicuous Gallantry Medal (Flying)

W/O. H. F. McP. TAYLOR, No. 156 Sqn.—This warrant officer has completed a fine record of operational work, in the course of which he has displayed sustained courage and devotion to duty. His missions include attacks on targets in Germany, Italy and occupied territory, which he has pressed home in the face of much opposition.

Flt. Sgt. A. F. ELCOATE, D.F.M., No. 156 Sqn.—Flt. Sgt. Elcoate has taken part in numerous operational sorties with great keenness. Recently he has trained himself to be a bomb aimer with excellent results, though his air crew category is that of wireless operator/air gunner.

A Catafighter Hurricane on its catapult mounting in the bows of a merchantman at a North African port.

Bar to Distinguished Flying Medal

Flt. Sgt. (now W/O.) E. LEAVESLEY, D.F.M., No. 106 Sqn.—Since the award of the D.F.M., Flt. Sgt. Leavesley has completed many sorties, continuing to display cool courage and quiet efficiency. His technical ability and knowledge have been of the greatest assistance to his pilot and navigator, and not once has he had a wireless failure.

Distinguished Flying Medal

Flt. Sgt. S. ALLEN, No. 50 Sqn.—Flt. Sgt. Allen has taken part in raids on several German and Italian targets. In December, 1942, he participated in a successful low-level attack. On the return journey, while still at a low altitude, the aircraft sustained severe damage from anti-aircraft fire. One engine was disabled, the elevator trimming tabs were shot away, and the hydraulics rendered useless. Throughout the homeward flight in the crippled aircraft, Flt. Sgt. Allen secured extremely helpful wireless assistance. On a previous occasion this airman was instrumental in saving an aircraft which had been lost over Holland and eventually landed in this country with only ten gallons of petrol to spare.

Flt. Sgt. J. ALLINSON, No. 61 Sqn.—This airman has been a member of two outstanding crews. He has invariably displayed keenness, and his skilful advice and vigilance have enabled his captain to avoid enemy night fighters on many occasions, and thus contributed greatly to the success of the sorties.

Flt. Sgt. C. O. AUBERT, R.A.A.F., No. 12 Sqn.—Flt. Sgt. Aubert has taken part in many operational sorties against the enemy's most heavily defended targets, including Kiel, Essen, Dusseldorf and Hamburg. On one occasion in January, 1943, despite intense anti-aircraft fire over Essen, this airman obtained a good photograph.

Flt. Sgt. D. AXTELL, No. 51 Sqn.—Flt. Sgt. Axtell has taken part in a large number of operational sorties and four escort patrols. He has always shown consistent keenness, and his fine technical knowledge, exceptional initiative, resourcefulness and skill have proved a big asset to the completion of many successful sorties.

Flt. Sgt. (now W/O.) S. BACK, R.C.A.F., No. 59 Sqn.—This airman has served with the squadron since January, 1942. The crew of which he is a member has been consistently successful on operations. He participated in many hazardous sorties against enemy shipping off the Dutch coast. In July, 1942, he made a telling attack on two five thousand-ton enemy ships in the face of heavy anti-aircraft fire. Later in November, 1942, this airman took part with good effect in a most determined attack on shipping in a French harbour in spite of vigorous ground fire and adverse weather.

Flt. Sgt. W. G. BAKER, No. 61 Sqn.—This airman has completed a large number of operational sorties, each one of which has been most meticulously planned and accurately fulfilled. On his first operational flight as captain his aircraft was attacked simultaneously by two night fighters. By extremely skilful evasive action Flt. Sgt. Baker avoided both enemy aircraft.

Three-engined Expert

Flt. Sgt. M. M. CAPLAN, No. 158 Sqn.—Flt. Sgt. Caplan has just completed a most successful tour of operations, during which he has taken part in bombing attacks against targets in Germany and Italy, often in the face of intense fighter opposition and heavy ground defences. On three occasions this airman has brought his aircraft safely back to base on three engines, and he has also obtained some excellent photographs.

Flt. Sgt. H. DORLAND, R.A.A.F., No. 420 (R.C.A.F.) Sqn.—During the course of his tour of operations this airman has shown outstanding ability and courage as an air gunner. On one occasion, when returning from an attack on Stuttgart, his aircraft, when at a very low altitude, was engaged by searchlights and fire from ground defences. Flt. Sgt. Dorland successfully shot out the searchlights and silenced some of the guns, thereby enabling his captain to extricate his damaged aircraft. On a more recent occasion Flt. Sgt. Dorland was acting as fire controller in an aircraft returning from Cologne. An enemy fighter made five separate attacks in brilliant moonlight, but largely owing to the expert directions supplied by this airman, his captain was able to take successful evasive action.

Flt. Sgt. J. W. EINEARSON, R.C.A.F., No. 44 Sqn.—This pilot has displayed the greatest possible determination to locate and bomb his target on all possible occasions. He has taken part in many long and dangerous raids on a variety of targets in Germany and Italy, including the recent raids on Berlin. He has also secured good photographs.

Flt. Sgt. H. W. HAWKSLEY, No. 16 Sqn.—Flt. Sgt. Hawksley has a long record of operations against heavily defended targets in Germany, Italy and enemy-occupied territory.

Flt. Sgt. R. T. HOOD, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Flt. Sgt. Hood has been employed as rear gunner in one of the outstanding crews of the squadron. By his excellent directions, coolness and presence of mind, Flt. Sgt. Hood has enabled his pilot on many occasions to evade enemy opposition and complete the mission.

Flt. Sgt. S. G. KEATLEY, No. 7 Sqn.—This airman has exhibited great keenness and enthusiasm throughout his operational career. His efforts as wireless operator on numerous operational flights over such targets as Essen, Cologne, Genoa and Turin have been a source of encouragement to the other members of the crew.

Flt. Sgt. T. C. LATHAM, No. 61 Sqn.—This airman, throughout his operational career has always been an important member of exceptionally good crews. In the midst of heavy anti-aircraft fire over such targets as Berlin, Essen and Cologne he set a fine example of steadiness; while on longer flights to Genoa, Milan, Le Creusot or Turin, his experienced skill has enabled the aircraft to return safely and easily despite adverse weather.

Flt. Sgt. C. P. LUNDEEN, R.C.A.F., No 420 (R.C.A.F.) Sqn.—This airman has participated in operations with admirable determination and skill. On one occasion over Hamburg his excellent airmanship made it possible for his gunners to shoot down an attacking enemy fighter. Although his own aircraft was badly damaged, Flt. Sgt. Lundeen flew it safely to base. Later, while on a daylight sortie over Germany, he successfully bombed the target and, when the weather cleared unexpectedly, made skilful use of cloud cover to evade three enemy fighters which were in the vicinity.

Flt. Sgt. W. McG. MILLER, No. 50 Sqn.—As

a bomb aimer, Sgt. Miller has taken part in raids on the most highly fortified towns of Germany and Italy. He also participated in the daylight attacks on Le Creusot and Milan.

Flt. Sgt. A. C. Ogg, No. 76 Sqn.—Flt. Sgt. Ogg has flown on operations against the enemy continuously for eleven months. During that time as wireless operator he has taken part in attacks on many of the enemy's most heavily defended targets. On two occasions in adverse weather it has been mainly due to the initiative and technical skill of this airman that the aircraft has returned safely to base.

Land and Sea Targets

Flt. Sgt. E. Smith, No. 455 (R.A.A.F.) Sqn.—This airman participated as wireless operator/air gunner in 18 sorties while operating with Bomber Command. These include attacks on Essen, Brest, Munster and Dusseldorf and the sorties made in search of the *Scharnhorst* and *Gneisenau* on February 12th, 1942. While with Coastal Command Flt. Sgt. Smith has completed a further 17 sorties. These flights were all accomplished over the sea and were attended by much success.

Flt. Sgt. C. F. J. Sprack, No. 83 Sqn.—Nearly all the sorties accomplished by this airman have been over the more heavily defended targets in Germany, and have included two attacks on Berlin. On one occasion he participated in a daylight attack on the submarine harbour at Danzig. The weather was extremely adverse and the target was only located by exceptionally good crew co-operation. The excellent instructions given by Flt. Sgt. Sprack enabled the pilot to press the attack from low-level and to take the correct evasive action. On another occasion this airman displayed cool courage and devotion to duty when his aircraft was twice attacked by an enemy fighter while on the way to Duisburg. The enemy aircraft was shot down in flames by Flt. Sgt. Sprack when it made a second attack.

Flt. Sgt. (now W/O.) J. K. Stott, R.A.A.F., No. 61 Sqn.—Throughout his tour of operational duty Flt. Sgt. Stott has displayed the greatest skill and confidence as a navigator. He participated in the daylight raids on Le Creusot and Milan and in two recent night raids against Berlin.

Flt. Sgt. W. E. Waites, R.A.A.F., No. 455 (R.A.A.F.) Sqn.—On February 12th, 1942, this airman was navigator of an aircraft which successfully located and attacked the *Scharnhorst* and the *Gneisenau* off the Dutch coast. His navigational work has always been exceptionally effective.

Flt. Sgt. A. W. Wales, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Flt. Sgt. Wales has invariably pressed home his attacks with the utmost determination. He has displayed high qualities of leadership and his enthusiasm for operational duties has been a fine example to other members of his crew.

Flt. Sgt. J. L. Welch, No. 218 Sqn.—Flt. Sgt. Welch has taken part in a large number of operational sorties and is now engaged on his second tour of operational duty. On one occasion, in February, 1941, when returning from a sortie his aircraft was attacked by a Ju 88. Flt. Sgt. Welch, who was serving as front gunner, gave the hostile aircraft several telling bursts of fire and the engagement was quickly broken off by the enemy. On another occasion, in March, 1941, Flt. Sgt. Welch was flying in an aircraft which was attacked by four Me 110s. He shot one down and the remaining three fled on the arrival of fighter protection. This airman has also made many low-level machine gun attacks on concentrations of enemy troops and transport with much success.

Flt. Sgt. A. V. Willis, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—This airman has cheerfully and efficiently completed his duties as pilot. He has taken part in many operational flights during which his resourcefulness and skilful airmanship have inspired great confidence in his crew.

Flt. Sgt. J. R. Wolley, No. 61 Sqn.—This airman has taken part in many operational sorties, including attacks on numerous towns in Germany and Italy. Whatever the dangers and difficulties over the target area he invariably remained quietly and efficiently at his post, setting an excellent example to less experienced members of the crew.

Sgt. L. Bird, No. 218 Sqn.—Sgt. Bird has taken part in a large number of operational sorties and is now on a second tour of operational duty. Previously in February, 1941, when in Eritrea, he had been forced to leave his blazing aircraft by parachute and had been taken prisoner by the Italians, being released on the British occupation of Abyssinia. Resuming operational flying in June, 1942, Sgt. Bird destroyed an enemy night fighter.

Act. Flt. Sgt. F. W. T. Routledge, No. 83 Sqn.—Throughout his operational career Flt. Sgt. Routledge has shown outstanding ability and a fine fighting spirit. He has taken part in attacks against the most heavily defended targets in Germany, including Berlin, Hamburg, Essen, Bremen and Duisberg. One night in January, 1943, during the return flight after attacking Berlin his aircraft was hit by fire from heavy ground defences and two engines were put out of action. Later one of the two remaining engines began to give trouble and a forced alighting on the sea appeared imminent. In the most trying circumstances of this hazardous flight this airman's calm behaviour, unerring judgment and technical ability were of the utmost assistance to his captain and contributed much to the safe return of the bomber to its base.

Roll of Honour

Casualty Communiqué No. 233.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents, and natural deaths.

Of the names in this list 99 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

Killed in Action.—Sgt. R. E. Andrews; L.A/C. D. V. Bullen; Flt. Sgt. R. A. Clapson; Act. Sqn. Ldr. Viscount M. H. H. Clive; P/O. A. Eastwood; Sgt. W. Field; L.A/C. K. T. Franklin; P/O. R. C. Horton; Sgt. L. W. Hunt; L.A/C. H. V. Jopson; L.A/C. F. J. C. Keane; Sgt. J. I. M. Logan; Sgt. D. R. McDougle; Sgt. S. A. Morris; Sgt. C. F. Nicholson; A/C.1 A. T. Nottingham; Sgt. K. R. Pexman; Sgt. F. J. Pitcher; Act. Flt. Lt. H. M. Siewert; Sgt. K. S. Smith; Sgt. J. H. Staples; Act. Flt. Lt. C. R. Strange; L.A/C. J. Sweeney; Sgt. C. J. Westcott.

Previously Reported Missing, Believed Killed in Action, now Presumed Killed in Action.—Flt. Lt. R. B. Chadwick; Sgt. V. J. Coombs; P/O. T. B. Crowfoot; Sgt. F. W. Darley; Sgt. A. E. Holding; Sgt. W. J. Hopkins; Sgt. J. F. Killilea; Sgt. J. A. McKinstry; Flt. Sgt. T. I. R. Owen; P/O. B. G. Robinson; P/O. P. D. Smale; Sgt. J. R. Storey; Sgt. D. C. Ward; Sgt. A. Waring.

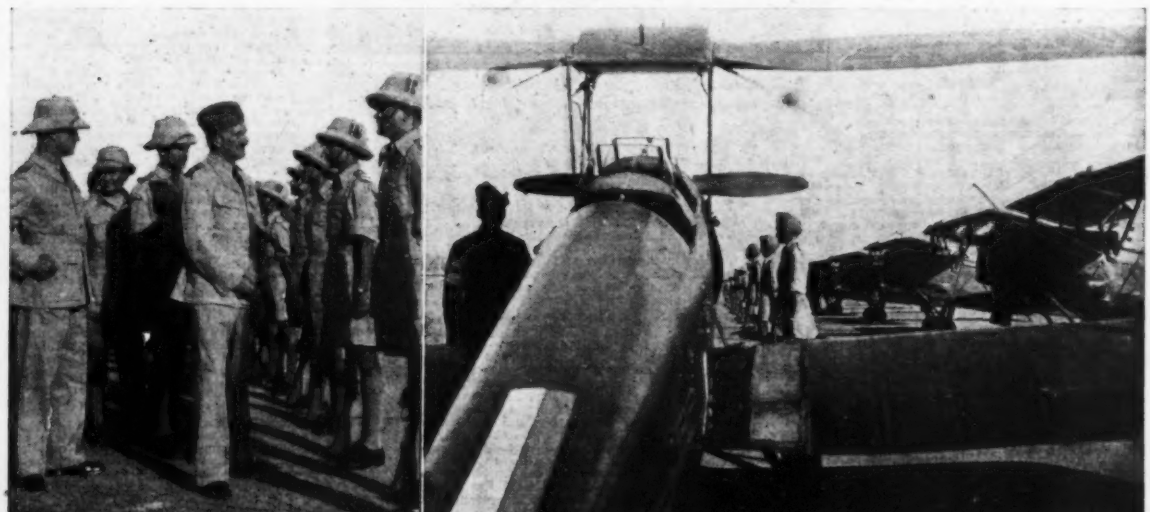
Previously Reported Missing, now Presumed Killed in Action.—Sgt. N. Acton; Sgt. A. Aldridge; P/O. A. A. Angel; Sgt. T. Barker; Sgt. W. G. Bate; Sgt. J. W. A. Bennett; Sgt. G. Blatherwick; Sgt. E. H. Bowmphrey; F/O. A. J. L. Bowes; Sgt. D. E. T. Burford; Flt. Sgt. E. G. Burton; Sgt. A. M. Clarke; Sgt. A. F. P. Cursett-Sutherland; Flt. Sgt. B. J. Davis; Act. Sqn. Ldr. L. H. Day, D.F.C.; P/O. W. H. Day; Sgt. A. C. Ezra; Flt. Sgt. M. J. Glynn; Sgt. E. C. Ibbotson; P/O. D. W. Ilott; Sgt. E. C. Isted; P/O. P. W. Kerry; Sgt. J. McCleary; Sgt. C. McGough; Wing Cdr. J. F. Maffett; Sgt. D. Morris; Sgt. J. D. Osbaldeston; Act. Flt. Lt. W. E. Perrin; Sgt. H. Price; Sgt. W. E. Pring; P/O. A. H. G. Sandon; Wing Cdr. G. H. Sheehan; Sgt. J. B. Smith; P/O. V. M. Smith; Flt. Sgt. H. R. Sprason; F/O. E. G. T. Symons; Sgt. F. C. G. Tate; P/O. J. La R. Taylor; Sgt. W. A. Titcomb; Sgt. R. E. Tomlinson; Flt. Sgt. A. J. R. Vineberg; Sgt. J. H. Westgate.

Died of Wounds or Injuries Received in Action.—P/O. J. T. Clarke; Sgt. B. L. Crane; Sgt. H. Shearer.

Missing, Believed Killed in Action.—P/O. L. H. R. Binning; Sgt. V. Brown; Sgt. W. E. Chamberlain; Sgt. E. W. L. Charlebois; Sgt. W. H. Clayton; Act. Sqn. Ldr. P. Goode; Sgt. F. A. Hughes; P/O. W. W. Kirkpatrick; Sgt. L. M. Lack; Sgt. J. Misseldine; Sgt. V. Page; Flt. Sgt. F. A. Pearson; Sgt. A. C. Sharpe; Flt. Sgt. W. Tatlow; Sgt. C. V. Walkinshaw; Sgt. D. H. Yorke.

Missing.—P/O. E. J. Almeroth; P/O. D. I. Arthur; Sqn. Ldr. M. Ballard; L.A/C. L. K. Baughan; Sgt. F. D. Bell; Flt. Sgt. W. S. Berry; L.A/C. C. F. Briercliffe; Sqn. Ldr. D. J. Brown; P/O. T. W. Challoner; Sgt. C. F. Chambers; L.A/C. B. A. Clemow; Sgt. T. B. Colwell; P/O. T. A. Corr; Sgt. F. P. Crawford; P/O. J. M. Cremer; Sgt. J. Dickinson; Sgt. E. J. Drew; L.A/C. D. R. Evans; Sgt. P. G. Exton; L.A/C. A. Fairhurst; Sgt. E. W. Foster; F/O. W. H. Franklin; L.A/C. J. R. Frankpitt; Cpl. A. French; Sgt. L. J. Gait; Sqn. Ldr. C. F. Gibson, D.F.C.; Flt. Sgt. W. Hann; Sgt. J. H. Harris; Sgt. T. E. Hastings; P/O. J. Henderson; Sgt. H. E. Hendon; Sgt. E. Hodgson; P/O. F. Holland; Sgt. M. J. Hudson; Sgt. J. C. Insole; L.A/C. T. A. James; F/O. C. W. Johnstone; Sgt. H. Jowitt; Sgt. J. H. Kempton; P/O. A. J. Kingham; Sgt. M. W. MacKenzie; P/O. G. McWilliam; Flt. Lt. H. L. Madge; Sgt. T. Mairs; Sgt. W. M. Meiklejohn; Sgt. F. J. Mowles; L.A/C. D. S. Murray; L.A/C. J. McD. Nelson; Flt. Lt. D. J. W. Page; Flt. Sgt. J. S. Rigden; L.A/C. W. Riley; Flt. Sgt. R. R. S. Rolfe; Flt. Lt. A. E. Prior; Sgt. H. Reddy; Sgt. H. J. Sharood; Sgt. A. C. Sixsmith; Sgt. J. E. Smith; Flt. Sgt. L. R. Smith; Flt. Lt. J. E. Soden; F/O. A. H. Stanley; Sgt. F. W. Stanners; Sqn. Ldr. W. J. Stewart; Flt. Sgt. A. Stokes, D.F.M.; Flt. Sgt. D. E. Street; Sgt. W. A. Wainwright; Sgt. L. P. Ward; Sgt. D. C. Wilson; F/O. H. L. Wynne, D.F.M.

Killed on Active Service.—Sgt. H. V. Adams; P/O. W. P. Bolton; Sgt. A. B. J. Burgess; Sgt. A. E. Clark; Sgt. T. R. Davis; Sgt. E. S. Evans; Sgt. E. Hall; W/O. J. R. T.



Air Marshal Sir J. E. A. Baldwin, K.B.E., C.B., D.S.O., Deputy A.O.C. in C., India, inspecting officer cadets of the Indian Air Force at a passing-out ceremony. On the right the pupils are parading in front of their D. H. Tiger Moths.

VICTORIA

AVIATION

Hazelton, D.F.M.; Sgt. W. A. Horsley; Sgt. F. C. Johnson; Sgt. D. W. Lovelady; P/O. A. J. Majury; Sgt. E. D. Murphy; L.A/C. K. T. Robson; A/C.1 L. J. Rogers; Sgt. D. C. Smith; Sgt. V. J. J. Stride; Sgt. D. R. Trigg; P/O. B. J. S. Vavasour; Sgt. A. J. H. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. R. Dickerson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. F. C. Gill.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. F. Hall; P/O. D. MacDonald; Sgt. R. A. Mitchell; A/C.2 D. Moyes; L.A/C. T. A. Rankin; P/O. N. G. Totty; L.A/C. A. J. Ward.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 D. N. Cotton; Sgt. A. J. Harvey.

DIED ON ACTIVE SERVICE.—A/C.1 J. H. Batty; L.A/C. W. A. Burfoot; P/O. R. Dick; A/C.1 V. Drinnan; A/C.1 D. G. F. Elliott; A/C.1 A. A. Lesser; Cpl. R. B. F. Lord; A/C.1 J. Rees.

Royal Australian Air Force

KILLED IN ACTION.—P/O. A. S. Campbell; P/O. R. A. McFarlane; P/O. B. W. Polson; Sgt. R. C. G. Rickett.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. F. E. Monckton; Sgt. G. C. Thomson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. W. A. Clegg; Sgt. A. Holland; Sgt. L. K. McMichael; Sgt. H. J. Mayne; Sgt. K. Newberry; Sgt. S. O. Simpson; Sgt. R. D. Smith; Sgt. G. A. Swan; Sgt. H. C. A. Warr.

MISSING, BELIEVED KILLED IN ACTION.—Act. Flt. Lt. N. T. Beacham; Sgt. H. M. Peake; Sgt. A. R. Roberts.

MISSING.—Flt. Sgt. D. C. Cropper; Sgt. R. M. McLay; Sgt. L. H. Schultz; Sgt. R. F. R. Sides.

KILLED ON ACTIVE SERVICE.—Sgt. F. J. McN. Barber; Sgt. B. G. G. Francis; F/O. H. C. McKenzie.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. F. R. O'Neill.

Royal Canadian Air Force

KILLED IN ACTION.—P/O. H. J. Crowe; Act. W/O. L. G. Dobson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. K. A. Peters.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. R. G. Blamires; Sgt. J. Brelvis; Sgt. L. J. Capton; Sgt. A. M. Carter; Sgt. B. B. Copeland; Flt. Sgt. I. W. Garfin; P/O. A. M. Greene; P/O. J. C. Kitchen; Sgt. C. F. Lloyd; Sgt. W. G. McCron; F/O. E. C. Olsen; Sgt. W. E. Pilborough; Sgt. H. E. Prime; P/O. H. R. Russell; P/O. V. N. Salmon.

MISSING, BELIEVED KILLED IN ACTION.—P/O. B. H. Labarge; Flt. Sgt. G. W. Miller; P/O. G. W. Sellers.

MISSING.—Sgt. J. A. Corbett; P/O. S. H. K. Goodyear; Sgt. G. R. D. Hall; Sgt. C. O. Henderson; Flt. Sgt. D. C. Lisson; P/O. J. D. MacFarlane; Flt. Sgt. E. S. Masson; Flt. Sgt. M. P. Myers; Sgt. D. Neale; F/O. W. McL. Palmer; Sgt. D. R. Ross; Sgt. R. A. W. Sharpe; Act. Flt. Lt. H. G. Shockley; F/O. R. W. Taylor, D.F.C.; Sgt. C. H. Tidy.

KILLED ON ACTIVE SERVICE.—P/O. A. J. Daiken; Sgt. O. C. Dunn; Sgt. A. E. Hannay; Sgt. Q. MacP. Shippee; P/O. B. H. Zdan.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. G. W. Forster.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. H. E. Ash.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. M. J. Byrne; Sgt. T. E. Crarer; Flt. Sgt. J. E. Gilbertson; Sgt. H. L. Green; P/O. R. S. Lees; Flt. Sgt. N. R. Meyer; Flt Sgt. C. C. Newlove; P/O. N. B. Robertson; P/O. I. J. Shepherd; Flt. Sgt. D. R. White; Sgt. J. F. Winstanley.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. P. H. Skinner.

MISSING.—Sgt. H. R. Harrap.

KILLED ON ACTIVE SERVICE.—Sgt. W. C. Asher; Sgt. J. Brims; F/O. J. Cowan; Sgt. J. H. Lawson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. W. K. Rendall.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Air Sgt. J. E. Phelps.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Lt. L. O. B. Player.

MISSING.—Lt. B. R. Bennetts; Capt. J. J. Orr.

Indian Air Force

KILLED ON ACTIVE SERVICE.—P/O. B. R. Sanjana.

Casualty Communiqué No. 234.

Of the names in this list 120 are second entries giving later information of casualties published in earlier lists.

Rearming the starboard 0.303 guns on a tropicalised Spitfire in Australia.

Royal Air Force

KILLED IN ACTION.—Sgt. R. V. Batten; Flt. Sgt. A. E. Cooper; Sgt. W. S. Norris; Sgt. G. W. Wicks.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. B. Blatchley; Flt. Sgt. J. Bradbury, Sgt. S. Briggs; Sgt. P. R. Cooper; Sgt. V. R. Dufton; Flt. Lt. J. D. Fletcher; Sgt. F. G. Huntley; Sgt. D. M. Laing; Flt. Sgt. G. H. Mays; Wing Cdr. R. Sawrey-Cookson, D.S.O., D.F.C.; Sgt. L. E. Taylor; Sgt. A. H. Wincott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. E. C. Adams; P/O. T. R. Ashton; Sqn. Ldr. M. R. Atkinson; Sgt. H. G. Baden; Sgt. E. W. Barfield; Sgt. W. B. Barr; Sgt. W. J. Bartholomew; Sgt. V. J. F. Bicat; Sgt. R. Brooke; Sgt. P. S. Brunsdon; Sgt. G. A. Burrell; P/O. B. Challis; Flt. Sgt. F. Chapman; Sgt. R. Cowley; P/O. J. D. Crombie; Flt. Sgt. P. Cross; Flt. Sgt. M. M. Crowe; Sgt. E. K. Davies; Sgt. R. A. H. Dolan; Sgt. H. N. Deckman; Sgt. J. A. Dowling; Sgt. L. R. Dye; Sgt. L. R. Elvin; P/O. F. B. Franklin; Act. Sqn. Ldr. J. H. Franks, D.F.C.; Sgt. P. E. Gartell; Sgt. J. G. Green; Flt. Sgt. D. E. Hall; Sgt. J. P. Hankins; P/O. B. H. Harmer; Sgt. L. D. Harris; Sgt. R. Henderson; Sgt. W. B. Henvey; Sgt. E. C. Horton; Sgt. H. H. Hudson; Sgt. R. S. Hughes; Sgt. I. James; Sgt. W. K. Jones; Act. Flt. Lt. W. A. R. Keddie; P/O. P. H. N. Lambert; Flt. Lt. E. C. Lane-Sansam, D.F.C.; F/O. J. C. D. Langley; Sgt. D. S. Large; Flt. Sgt. I. G. I. Lewis; Sgt. A. E. Lewry; Flt. Sgt. W. Lonsdale; Act. Sqn. Ldr. F. P. J. McGevor, D.F.M.; Sgt. F. Manley; Sgt. T. H. May; F/O. F. J. R. T. Minster; Sgt. L. Mitchell; Sgt. J. Moore; Sgt. R. W. Morgan; Sgt. F. W. Morrell; Sgt. J. Oliphant; P/O. P. E. O'Meara; F/O. D. O. Osborne; Sgt. G. V. Phillips; Sgt. N. F. Poulton; Sgt. G. C. Pratt; Sgt. J. G. Reid; Sgt. K. S. Revell; Flt. Sgt. T. Rooney; Sgt. K. E. Savage; Sgt. A. Scott; Sgt. L. H. Seal; Sgt. J. T. Shapcott; Sgt. B. F. Short; Sgt. R. F. Shorthouse; W/O. J. G. Simpkin; Sgt. D. Smith; Sgt. N. Spray; Sgt. T. C. Stobie; Sgt. J. G. Strachan; Sgt. E. R. Taxeira de Mattos; Sgt. L. M. Tetley; Sgt. P. E. Thomas; Sgt. J. Ward; P/O. D. A. Welch; Flt. Sgt. L. West; Sgt. J. R. Williams; Sgt. G. E. Williamson; F/O. F. P. Winter-Taylor; Sgt. W. L. L. Woodford; Flt. Lt. K. B. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. J. H. Campbell.

WOUNDED OR INJURED IN ACTION.—P/O. D. C. Lowe; P/O. L. R. S. Luton; P/O. J. W. McGavin; Sgt. F. Milligan.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. F. L. Varney.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. A. Allan; Sgt. R. Heslop; Sgt. R. J. Jenkins; F/O. R. C. Morris, D.F.C.; Sgt. H. C. A. Newland; Sgt. F. Stephens; F/O. D. R. Tuft; Sgt. D. Wilkie; Sgt. R. Wilson.

MISSING.—Flt. Sgt. W. Arnott; Sgt. R. G. Bacon; Sgt. F. E. Bailey; Sgt. A. E. Beaven; Sgt. S. Bell; Sgt. W. Bell; Flt. Sgt. W. E. Boardman; P/O. T. H. Brown; F/O. D. A. Bruce; Sgt. R. L. Cole; Sgt. M. H. C. Crow; Sgt. D. J. Druett; Sgt. G. C. Dynes; Sgt. P. J. Edwards; F/O. F. C. Elisha; F/O. H. J. Espy; P/O. J. G. Firth; Sgt. R. W. Floyd; Sgt. J. D. Haigh; Flt. Sgt. A. J. Horwood; F/O. A. D. Johnson; Flt. Sgt. N. C. Jones, D.F.M.; Flt. Sgt. G. Jowett; Sgt. B. Kelly; F/O. A. J. Lane; Sgt. R. McKerrell; Sgt. G. E. Moore; Sgt. J. R. Oliver; Sgt. C. A. Partridge; Sgt. C. Pattison; Sgt. J. C. Perry; P/O. F. J. Pickard; Sgt. G. Preston; Sgt. J. S. Priestley; F/O. H. Ramsey; Sgt. E. S. Rhodes; Sgt. L. W. J. Schultz; Sgt. G. McC. Sheridan; P/O. P. Smailes; Sgt. R. C. Smith; Sgt. R. K. Blower; Sgt. P. S. Burrow; Sgt. W. Carpenter; Sgt. F. Chilton; Sgt. E. O. Cookson; Sgt. S. J. Coombes; Sgt. C. H. Crippe; P/O. F. H. Cumming; Sgt. J. L. Davis; Sgt. L. J. Derrick; Sgt. W. T. Dynes; Sgt. D. Y. McRobb; Sgt. D. Mason; Sgt. L. Nash; Sgt. T. J. Street; Sgt. H. G. Sutton; Sgt. R. W. Taylor; Sgt. A. H. Thomas; F/O. F. G. Whelpdale; W/O. P. N. B. Williams; Sgt. G. Wilson; Sgt. L. G. Wiltshire; Sgt. G. H. Yeates; Sgt. N. Young.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. R. H. M. Macfadzean.

KILLED ON ACTIVE SERVICE.—P/O. H. G. Banks; F/O. S. H. Cotton; A/C.1 A. B. Douthwaite; Sgt. S. A. F. Farmer; W/O. B. D. L. Gillman; L.A/C. W. H. Hale; Sgt. J. Hearne; Flt. Lt. C. R. Henry; Sgt. A. E. N. Hutson; P/O. A. L. D. Jeyes; F/O. N. Kujundzic; Sgt. F. G. Last; Sgt. S. Lee; L.A/C. J. L. Lewis; Flt. Sgt. H. W. Macdonald; A/C.1 W. A. Moore; P/O. W. J. Olde; Sgt. A. C. Perrin; F/O. R. A. Prince; Sgt. G. F. Rawson; Flt. Sgt. R. E. Skinner; Sgt. O. Stoher; L.A/C. D. E. Winterton; Sgt. W. A. Woolley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. H. Bunyar; Sgt. S. Counsell; Sgt. D. McDonald.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. G. A. Stone.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—A/C.2 G. Crowley; L.A/C. R. B. Thorp.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. E. H. Askew; Sgt. C. H. Fletcher; L.A/C. J. Lindsay; Sgt. P. F. Lynch; Sgt. A. A. McClymont.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. G. A. Cullener; Sgt. J. Denyer; P/O. H. P. Harrison-Yates.

DIED ON ACTIVE SERVICE.—A/C.1 J. E. Bush; A/C.1 M. Devlin; L.A/C. D. R. Fender; Cpl. H. W. Gove; A/C.2 A. Grant; L.A/C. J. Hilditch; Sgt. P. C. Mercer; Flt. Sgt. A. J. Meredith; A/C.2 R. E. Owen; Flt. Sgt. R. Platt; Sgt. A. H. McG. Smith.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. W. E. Bates; Sgt. D. V. Ekbery; Sgt. W. R. Johnstone; Sgt. E. R. Moss.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. T. H. McIlveen.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. L. N. Johnston; Sgt. H. G. McKean; Sgt. W. W. Perroux; Sgt. L. M. Shephard.

MISSING.—Sgt. W. P. Adams; Flt. Sgt. R. J. Carrodus; Sgt. A. R. Cope; Sgt. D. L. Frost; Flt. Sgt. N. R. Goudie.

KILLED ON ACTIVE SERVICE.—P/O. W. W. Alexander; Sgt. N. Barker; Flt. Sgt. G. R. Jeffreys.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. C. A. McCreath; P/O. W. J. R. Vincent; Sgt. P. S. Woodhouse.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. A. D. Heins.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. D. G. Andrews.

Royal Canadian Air Force

KILLED IN ACTION.—Act. W/O. A. J. De Gruyenaere; P/O. A. MacD. Morrison.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. H. T. M. Cooper; Sgt. J. H. Smith.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. J. P. Maloney.

MISSING, BELIEVED KILLED IN ACTION.—Sgt.

SERVICE AVIATION

P. P. Fahie; Sgt. V. R. D. Kissick; Sgt. G. E. Somerville; Sgt. F. Ward; P/O. L. H. York.

MISSING.—Flt. Sgt. R. De Bourke; Flt. Sgt. H. H. Clements; Sgt. F. W. Guild; Flt. Sgt. R. W. G. Hogan; Flt. Sgt. J. McA. Newton; Sgt. J. H. Oliver; P/O. F. Prosperine; P/O. R. C. C. Smith; F/O. G. W. Wiley.

KILLED ON ACTIVE SERVICE.—Sgt. A. L. Card.

DIED ON ACTIVE SERVICE.—Sgt. E. B. Hadden.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. H. Alington; P/O. H. J. Woodrow.

WOUNDED OR INJURED IN ACTION.—F/O. C. Eddy.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. P. J. D. McGeehan, D.F.M.; F/O. F. L. M. Whibley.

MISSING.—P/O. M. Lord; F/O. J. H. Naylor; Flt. Sgt. D. Wellington.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. W. N. Clark; F/O. R. L. Jones.

South African Air Force

KILLED IN ACTION.—Lt. R. H. Denehy.

WOUNDED OR INJURED IN ACTION.—Air Sgt. W. Higgs; 2/Lt. J. M. Scott.

MISSING.—Capt. M. Currie.

DIED ON ACTIVE SERVICE.—Sgt. K. E. Cohen.

Casualty Communiqué No. 235.

Of the names in this list 116 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. G. S. Clear, D.F.C.; F/O. A. N. E. Cobb; Sgt. H. E. J. Hale; Sgt. F. D. Hawkes; Sgt. J. A. Jackson; F/O. B. A. Johnson; Sgt. I. Taylor; Flt. Lt. M. M. Wayman, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. D. Adams; P/O. J. Allen; F/O. C. H. Anderson; Sgt. J. Bingham; Sgt. L. J. Blackmore; Sgt. W. Bluck; Sgt. D. W. Constance; Sgt. D. O. R. Dawson; Sgt. G. Dennison; Sgt. E. L. Dickerson; Flt. Sgt. L. G. Dunkling; Sgt. G. E. Dunn; Sgt. J. W. Gardner; Sgt. J. R. Goodings; Flt. Sgt. W. Graham; P/O. A. H. Hanson, D.F.C.; Sgt. R. Helyar; Sgt. K. R. Hobbs; Sgt. M. Hill; Flt. Sgt. H. J. Humphrey; Sgt. F. H. Huntley; Sgt. R. T. Jeans; Sgt. A. H. Jones; Flt. Sgt. K. McAusland; Sgt. J. McIlveen; Sgt. J. G. Mellor; Flt. Sgt. J. H. Millins; Flt. Sgt. D. E. Morgan; Act. Sqn. Ldr. P. B. Robinson, D.F.C.; Sgt. H. Scrace; Sgt. T. Shoesmith; F/O. W. A. Skelton; F/O. W. T. Smith; Flt. Sgt. D. H. Taylor; P/O. W. A. Thomas; Act. Flt. Lt. J. R. Traill; Flt. Lt. W. H. Wakefield; Wing Cdr. A. P. Walsh, D.F.C., A.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. D. L. Atkinson; Sgt. D. W. Brett; Flt. Lt. R. M. Buchan, D.F.C.; Sgt. J. A. Chadaway; Sgt. T. Crump; Act. Sgt. R. A. Currie; A/C.2 A. S. Day; Wing Cdr. F. W. Dixon-Wright, D.F.C.; Sgt. B. J. Dove; Flt. Sgt. E. H. Erby; Sgt. D. G. A. Evans; P/O. T. F. B. Geary; Flt. Sgt. B. O. George; Sgt. G. W. Howes; Sgt. R. A. Hudd; W/O. E. E. Ilett; P/O. G. G. Jeary; P/O. F. W. Jones; Sgt. D. F. Keane; Sgt. T. H. Kidd; Sgt. J. Mainwaring; Sgt. A. J. Marshall; Sgt. L. R. Meager; F/O. W. Murray; Sgt. F. Newbound; Sgt. G. E. Newman; Sgt. E. V. Norman; Flt. Sgt. R. E. Pithers; Sgt. H. D. Quintrell; Flt. Sgt. J. V. Routledge; Sgt. E. G. W. Shotter; Sgt. W. Smith; Sgt. P. Squires; Sgt. V. L. Stephens; P/O. J. F. Stock; Sgt. W. E. Thomas; P/O. R. G. Walder; Sgt. W. McD. Watson; Act. Group Capt. E. B. Webb; Flt. Sgt. H. H. Witts.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. C. F. Thornton.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. R. D. Cooper; Sgt. E. C. Crook.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. K. Brown; Sgt. T. J. Davey; Sgt. R. Dyson; Sgt. S. Griffiths; Flt. Sgt. J. McC. Tait.

MISSING.—Flt. Sgt. S. Adams; Sgt. R. Anderson; Sgt. D. Ansley; Sgt. G. W. F. Baker; Sgt. E. F. Ball; L.A/C. J. F. Bartlett; P/O. A. D. Bebbington, M.M.; Sgt. L. P. J. Bellaby; Sgt. K. Benjamin; Sgt. C. L. Blackford; Sgt. W. J. S. Boyd; Cpl W. J. Brewer; P/O. K. C. Briffett; Sgt. F. J. Brotherton; Sgt. D. Brown; P/O. R. L. Bulley; L.A/C. J. G. Burton; L.A/C. J. Buxton; Sgt. T. N. Chadwick; P/O. E. Challis; Sgt. D. W. Chambers; L.A/C. C. V. Cox; Sgt. A. J. Crosson; L.A/C. R. G. Dodson; L.A/C. E. Eccles; Sgt. E. D. Edwards; A/C.1 J. S. Elias; L.A/C. H. J. Emery; Sgt. N. S. Farr; Sgt. T. Fazakerley; Sgt. L. C. A. Fisk; P/O. I. T. S. Fulton; L.A/C. S. A. J. Garner; Sgt. F. P. Goodridge; Sgt. E. G. Greenhill; Sgt. A. Grant; Sgt. K. F. Green; Sgt. E. Greenhalgh; Act. Sqn. Ldr. E. L. Hayward, D.F.C.; Sgt. L. W. Hayward; L.A/C. E. W. P. Hedley; Flt. Sgt. E. C. Hibburt; A/C.2 J. E. Hill; Sgt. R. Holloway; Sgt. J. W. Houlgrave; Sgt. J. G. Hubbard; Sgt. E. G. Hunt; L.A/C. R. O. Jeskins; Sgt. L. G. Jones; Sgt. A. Kemp; Sgt. R. H. Lawrence; Sgt. G. K. Leighton; Sgt. R. C. Link; Sgt. H. W. Little; F/O. W. J. Locke; Sgt. A. Mackenzie; P/O. E. H. Mantle, D.F.M.; L.A/C. J. Martin; Sgt. R. G. Martin; Sgt. M. W. Metcalfe; F/O. G. K. W. Newton; Sgt. W. C. Nicholson; L.A/C. W. J. R. Parry; Sgt. C. K. Phin; L.A/C. H. Pinchin; Sgt. S. Poole; Sgt. C. T. Price; P/O. G. V. Pryor, D.F.M.; Sgt. J. P. Redmond; Sgt. J. Robertson; Sgt. R. Rutherford; Sgt. R. P. T. Saunders; Flt. Sgt. J. G. Shepherd; Sgt. R. V. Smith; Sgt. W. A. Smith; P/O. J. F. Spencer; Sqn. Ldr. I. G. Statham, A.F.C.; Sgt. D. W. Thomas; Sgt. U. Thomas; Sqn. Ldr. J. A. Tinne; Sgt. F. J. Trusler; P/O. A. Urquhart; Sgt. F. J. Walder; Sgt. R. J. Wallis; F/O. R. E. Weight; Sgt. R. J. Whatley; Sgt. A. Wilson; Sgt. S. A. Woodrow; L.A/C. S. Wright; Sgt. W. A. Wyse; F/O. J. O. Young; F/O. L. Young.

KILLED ON ACTIVE SERVICE.—F/O. T. G. Bridges; Sgt. H. J. Austin; Sgt. J. F. Bain; Sgt. J. E. Bird; Cpl. B. C. Broadbent; Sgt. B. Carey; Flt. Sgt. H. Clark; Sgt. P. R. Comley; Flt. Sgt. A. Grieve; P/O. T. K. Halliwell; Sgt. I. H. Hazard; L.A/C. G. H. Hicks; A/C.2 F. E. Hughes; Sgt. A. N. Hunter; Sgt. H. W. Jackson; Sgt. T. Jenkins; L.A/C. D. W. Macdonald; Sgt. W. A. McKinley; Sgt. W. Monkhouse; Sgt. A. Moore; F/O. W. C. Morris; Sgt. H. Pike; Sgt. A. Richards; Sgt. H. A. Rideout; Sgt. P. H. Ryder; Sgt. D. N. Smallie; Sgt. F. B. Smith; Sgt. E. F. H. Stephens; L.A/C. J. G. Stoneham; F/O. R. H. Thompson; Sgt. H. W. Walpole; Sgt. L. E. V. Webb; F/O. A. E. Wheeler, D.F.C.; Sgt. D. G. White.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. B. Campbell; Sgt. D. E. Killelea; Sgt. E. W. Mallett; Sgt. J. Milligan; Sgt. B. W. Swaffield.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. H. S. Boast; Sgt. S. Butterworth; A/C.1 E. Douglas; L.A/C. L. O. Lord; Sgt. A. I. Moss; L.A/C. H. E. Parsons; A/C.2 A. R. E. Verlander; A/C.1 G. Whitfield.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. A. J. Betts; Sgt. W. E. Williams.

DIED ON ACTIVE SERVICE.—L.A/C. J. T. Dinnage; A/C.2 O. Franks; Cpl. S. Gibbons; L.A/C. L. R. Goulsbra; L.A/C. N. Innes; A/C.2 S. W. Joseland; Cpl. F. W. Long; A/C.2 E. R. Sills; L.A/C. W. A. White; Cpl. G. S. Wise; A/C.1 W. Wright.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. M. A. Collin.

Royal Australian Air Force

KILLED IN ACTION.—F/O. W. J. Kennedy.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. P. P. Adams; Sgt. J. A. Alcorn; Sgt. A. N. Blackley; Sgt. C. E. Johnson; Sgt. C. D. Kennedy; P/O. M. J. Martel; Sgt. J. G. O'Sullivan; Sgt. T. E. Parsons; Sgt. B. W. Richards; Sgt. C. J. Stallard; Sgt. A. Wyles.

MISSING.—Sgt. J. B. Bayliss; Flt. Sgt. S. N. Curtiss; Sgt. D. J. Rae; Sgt. D. E. Somervell.

KILLED ON ACTIVE SERVICE.—Sgt. A. Lorenz; Sgt. T. C. Stevens.

Russian fighter pilots of a Hawker Hurricane-equipped squadron on the Eastern front.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. W. C. R. Foerster; Flt. Sgt. W. L. Hurl; Sgt. R. H. O'Brien.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. L. Sturgess.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. B. S. Biden; Flt. Sgt. W. J. Cadger; Sgt. R. S. Doherty; Sgt. P. J. Fernie; Flt. Sgt. J. A. L. Giroux; Flt. Sgt. H. R. Hamilton; P/O. R. J. Jackson; P/O. M. F. Johnson; Flt. Sgt. J. R. Kennedy; Flt. Sgt. W. M. Kostyshyn; P/O. E. N. MacDonell; Sgt. D. McDonald; Sgt. J. B. Pleasance; P/O. W. L. Quinn; F/O. L. H. Smith; Sgt. R. Wishart.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. P. E. Barron; Sgt. S. V. Bradshaw; P/O. B. A. Grant; F/O. C. E. Porter.

MISSING.—F/O. L. O. Armstrong; Sgt. R. F. Beckett; Sgt. R. L. Brandow; P/O. J. L. R. Cartier; Sgt. D. R. Chalmers; Sgt. C. W. Cockaday; P/O. A. T. L. Cullum; Sgt. C. St. C. Foster; Sgt. J. J. Goldspink; Sgt. J. M. Greer; Sgt. P. B. Gustavsen; Flt. Sgt. G. T. Hillman; F/O. R. D. McAdam; Sgt. G. McGrath; Act. Flt. Lt. D. M. McKenzie; P/O. R. G. McLean; Sgt. R. M. McLeod; Sgt. F. A. McNutt; Flt. Sgt. J. N. Miller; Sgt. W. H. Penrose; Sgt. H. C. Sleep; Sgt. J. Tongue; P/O. J. J. H. Turnbull; Sgt. H. S. Young.

KILLED ON ACTIVE SERVICE.—P/O. A. H. Fletcher; Flt. Sgt. J. C. Haist; Sgt. D. V. Kaye.

DIED ON ACTIVE SERVICE.—Sgt. C. A. J. Gordon.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. T. Kay.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. L. Kelly; P/O. R. W. J. Trengrove; Sgt F. R. West.

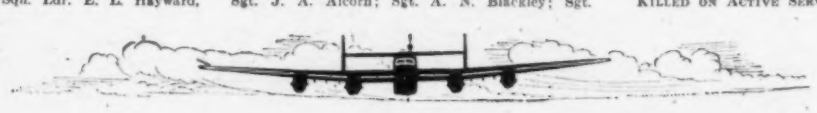
WOUNDED OR INJURED IN AATION.—Sgt. R. Treacher.

MISSING.—Sgt. O. E. Collins; Sgt. J. C. Donaldson; F/O. H. R. Leckie; Sgt. J. B. Martyn; F/O. E. L. Sadler; Sgt. J. A. Wilson.

KILLED ON ACTIVE SERVICE.—F/O. E. B. Harvey; Sgt. B. K. Werohia.

South African Air Force

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. R. D. Jarvis; Lt. D. W. Van de Meulen.

MISSING.—Act. Maj. H. J. Bolt; Lt. R. M. Hilligan; Lt. D. F. Symons.

KILLED ON ACTIVE SERVICE.—Lt. L. C. Weir.